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The Basis of Calculating Mining Tonnage Costs

The communication from Mr. William Hague under the above caption, printed elsewhere in this issue, reopens an old subject of discussion, viz., What is the basis upon which mining costs should be computed? Unless there be some understanding about this, or a specific explanation in connection with every presentation of figures, there is likely to be confusion and the making of improper comparisons, just as Mr. Hague has pointed out. It will be useful to review some of the fundamental conditions that obtain in mining.

Mines possess widely different characteristics. Some are opened in large, sharply defined orebodies, which can be cleanly extracted without taking any of the country rock, whereof the entire product may be sent to the mill. Another class is opened in thin orebodies, wherein it is necessary to take out a more or less width of barren rock, although the ore itself may be sharply defined, in order to make room in which to work to get the ore. Another class of mines is opened in orebodies that fade out gradually, the limit of extraction being determined by the profit realizable, which is generally a fluctuating factor. Finally, there is the class of mines that is unquestionably of the most importance, wherein the ore is more or less mixed with worthless material that must be extracted in order to get the ore.

In the last class of mines always, and in our second class to a certain extent, the entire process from the mining to the delivery of the product from the mill is one of concentration. This begins underground in the effort to break the least possible amount of worthless rock. It continues through the processes of hand-sorting underground, hand-sorting in the rock-house, hand-sorting in the mill, and finally (in the case of dressing works) mechanical sorting. In mines where the practice is necessarily of this nature, and their name is legion, the question is what should be the basis for determining the cost of mining per ton of ore?

Theoretically, the true basis for comparison is, we think, the number of cubic feet of ground stoped, which takes into account the specific gravity of the ore, a factor of consequence that is generally disregarded. This system of measurement finds a practical expression in the fathom basis, sometimes employed in connection with underground contract work in the copper mines of Lake Superior. Several years ago Mr. Hugh F. Marriott undertook to introduce in certain mines of the Witwatersrand the unit of square fathom of vein area stoped. If veins were of a uniform thickness, which they are not, this would be equivalent to a volume basis. However, Mr. Marriott's proposal did not meet with favor, and for our own part we grant freely that, although a volume basis may be theoretically ideal, practically it is out of the consideration.

The question consequently resolves itself substantially into the two alternatives: Shall the cost of mining be referred to the tonnage of ore raised, or to the tonnage milled? The answer is not quite simple. A figure referred to the tonnage raised may fail to be a true index, because a large quantity of rock or low-grade ore may have been separated underground and filled into old stopes. On the other hand, two mines of the same kind and the same district may exhibit a difference in practice after the ore has been hoisted. One may sort out a good deal of waste at the shaft and forward to the mill what is already a partially concentrated product; while the other may send the entire product to the mill and there perform the same kind of preliminary sorting, which then becomes distinctly a part of the milling process.

It would be desirable if we could have some standardization respecting this question in accounting, but we fear that the difficulties are prohibitory. Anyway

we hope that Mr. Hague's communication will lead to some further discussion of this subject, which is of perennial interest.

Explosives

The article on "Recent Developments in Explosives," by A. E. Anderson, presented elsewhere in this issue of the JOURNAL, will bear careful reading. To those familiar with the chemistry of explosives, there will probably appear little that is new. The article contains much, however, that is not only interesting, but important that those engaged in mining, in the actual breaking of ground, should know. The original of this article was presented recently as a lecture to the mining men of Telluride, Colo., with special reference to Western practice.

The developments in the manufacture of this essential to the miner, that have been made during the last 100 years, have followed careful experimentation and have kept pace with the demands made by the constantly increasing scope of the mining industry, and the requirements of efficient work. They have resulted in the evolution from a single product, black blasting powder, of a great variety of low- and high-power explosives; with these, also, have been evolved the necessary devices, known as detonators, to explode properly the charge itself. It is now possible to prepare a charge with such a combination of powders or gelatins, that, with the proper detonator, much more effective results can be obtained and at no greater cost than heretofore.

Of not the least importance is the proper handling of explosives in general, but of these new high explosives in particular. Many of the precautions advocated by Mr. Anderson are so obvious as to make the emphasizing of them seem almost unnecessary. However, to those in possession of any list of mining accidents over a period of the last few years, the number of such due directly to explosives will at once be recalled. If the precautions suggested in this article were universally and faithfully observed, there would be little question that accidents due to the mishandling of explosives would nearly or entirely cease. Such a happy result is, of course, not to be expected; but it is the ideal condition, and as such should be striven for.

The Paralysis of Mining Districts

The Director of the U. S. Geological Survey has made a name for himself as the giver of excellent advice respecting needed amendments of the mining laws of this land. It is a pity that the gentlemen who represent the people in the halls of Congress will not, anyway do not, heed his words. In his last annual report he makes a commendable suggestion, as follows:

> In the case of unpatented claims a remedy should be sought for what has been termed "the paralysis of mining districts," and the rigid requirement of annual assessment work should be made actual and effective by inspection and supervision, in order to put an end to the present procedure of allowing a claim to lie idle for practically two years after its location, not to mention the many localities where claims are held year after year with only perfunctory compliance, or even without any performance of assessment work—a type of local disregard for law that is in striking contrast to the observation accorded to the district customs and regulations of earlier days, whereby the right of possession was made absolutely dependent upon continuous operation.

In the midst of the play of boundless ambition in Washington for new bureaus to be organized, new jobs to be created and new literature to be disseminated, Uncle Sam does not seem able to manage his own property. The director of the Survey has pointed to this case of the unpatented mineral claims, the property of the Government but held by locators under conditions, the evasion of which has long been a joke.

Let the Government attend to its own. Let the Bureau of Mines organize a corps of inspectors and bring triflers to book, incidentally providing a fine array of new jobs in the bureau. This would be a field of usefulness more worth while than the operation of "experiment stations."

As for the unworked patented claims, held for the unearned increment, let the States attend to them by a suitably adjusted system of taxation.

Southern Iron Rates

Alabama iron makers are protesting against the railroad rates from their furnaces to Western points. The present rate from Birmingham to St. Louis is $3.75, and to Chicago, $4.35; which work out to 0.85 and 0.67c. per ton-mile, respectively. These seem rather high rates for freight like pig iron, which is moved in carload lots at the least, requires no special care and is not subject to damage—in a word, is low-class freight, and should get the lowest rates. The Southern ironmasters, however, do not base their complaint so much on the ton-mile charge as on the fact that rates are the same now, when pig iron is selling around $10 at furnace, as they were when it was bringing $2 or $3 more. They are willing that the railroads should take their share, but think that the carrier should be ready to divide the burden of lower prices with the producer. Another article of their complaint is that the high freights put them at a disadvantage in the Western markets in the competition with Northern furnaces.

As the large majority of the Southern furnaces are merchant furnaces and sellers of foundry iron chiefly, this question is an important one to them. But if they undertake to put the question of rates, not on the basis of the service actually rendered by the carrier, but on that of a division of profits, they complicate the matter and raise questions which will make the already difficult matter of rates even harder to settle than it is already—and that is saying much.

Steel Corporation Earnings in 1911

The reports of fourth-quarter earnings of the United States Steel Corporation, showing $23,105,115, against $29,600,000 in the third quarter, is somewhat better than was expected. It is doubtful, however, whether the unseen charges for depreciation, etc., were as liberal in the fourth as in the two preceding quarters. Realized prices in the fourth quarter were materially below those in the preceding quarter, and the tonnage was not greatly increased. In the present quarter realized prices will be no higher than in the fourth quarter, if as high, but the tonnage will be greater, pointing to earnings for this quarter of about $25,000,000. Quoted prices are, of course, higher, but the selling for this quarter was done when prices were at their lowest.

The fourth quarter's earnings bring the total for the year up to $104,355,463, which is below that for 1910 by $38,788,378; and is the smallest total since 1908, showing a gain of $12,507,853 over that year of extreme depression.

Metallics

Ore can be transported by burro from mine to mill or railroad in the Parral, Mexico, camp for from one to 1.50 pesos per metric ton for distances upward of two miles.

The Murex process of magnetic separation is in use by the Cordova Copper Co., and also at a plant at Malines, France. It is reported that other installations are being made.

At Stratton's Independence mill, in the last fiscal year, the wear and loss of steel in the chilean mill rolled-steel tires was 0.43 lb., and in the dies 0.19 lb. per ton of ore crushed.

In the Aurora mine in eastern Chihuahua, owned by the Madero family, both wulfenite and vanadinite are found, associated with galena carrying low silver content. Some of the vanadinite as concentrates running 18% V_2O_5 has been shipped to England.

Unless solutions entering zinc boxes are fairly strong in free cyanide, it is advisable to allow strong cyanide solution to drip into the first compartment. Better precipitation is obtained thereby, and the formation of the troublesome "white precipitate" is largely avoided.

A boiler of commercial size has been built for testing the practical results in the flameless combustion of gas as developed by Prof. William A. Bone. This boiler, which has constructed for the Skinningrove Iron Co., of Yorkshire, is to be capable of evaporating 5500 lb. of water per hour; it is 4 ft. long, 10 ft. in diameter, and contains 110 three-inch tubes. It is to be fired with byproduct coke-oven gas.

According to the building laws of the city of New York, reinforced-concrete structures shall be so designed that the stresses in the concrete and steel shall not exceed the following limits: Extreme fiber stress in compression, 650 lb. per sq.in.; in direct compression, 500 lb.; in shearing, when all diagonal tension is resisted by steel, 150 lb., and 40 lb. in shearing when diagonal stresses are not so resisted.

At some mines on the Rand the mining system now in favor is a combination of old Rand methods and colliery practice. The circular shaft at the New Modderfontein will be provided with mechanical ventilators and large blocks of ore will be mined on a modified longwall system. At the Modderfontein B, these blocks measure 1000 ft. on the dip and are 750 ft. long. On the 2200-ft. level of the Crown mine, the two shafts are to be connected by a main haulage level 14½ ft. wide that will be three miles long, passing from one end of the property to the other. Electric traction will be used.

By The Way

Some recent company meetings have shown that all the insurgents are not in the Republican party.

An entirely accurate method of measuring the height of a cliff with an aneroid barometer is given in the *Pahaspa Quarterly*. Lower the barometer by a string and measure the string.

A convention of mining men is to be held at Spokane during February. The announcement that certain gentlemen will present a resolution in favor of an "increased coinage of silver dollars at a mint to be located in the Northwest" sounds like a voice from the grave.

A review of the year 1911 was published recently by a local paper, at Grants Pass, Ore. It is a model of terseness and brevity, as can be readily seen from the following reference to mining in that district: "Mining interests have been somewhat up and down during the year. The most exciting was the Higging strike in the Kerby district." By the substitution of other names in the last sentence, this résumé of the year could be aptly applied to many other camps.

One of the mysteries is who buys defunct mining stocks. Prices paid are generally low, indeed, but even at that, where do the buyers look for any profit? Now and then the securities of an estate are closed out at auction, and in the reports we are sure to find some item like this: "1000 shares of Garfunkel Mining Co.; $10,000 first-mortgage bonds same company, coupons from July, 1882 attached; $10 for the lot." But why the $10? Is the buyer accumulating a museum for posterity?

The following from the *White Pine News* emphasizes the need of knowledge concerning explosives, and of occasional review of precautions in their use, such as presented elsewhere in this issue: "While kneeling over a small fire, thawing out several sticks of frozen powder, W. R. Bauer was blown up and instantly killed by an explosion on the properties of the Ely Verde Copper Co., south of the steam-shovel pit of the Nevada Consolidated, where he was engaged in doing the annual assessment work."

There is a new patented device, known as a metalometer (U. S. pat. 1,009,660), which is intended "to easily and quickly determine" (poor infinitive) "approximately the value of an ore by a prospector or person without knowledge of chemistry, metallurgy, or electricity." However, "it is not intended to make quantitative determination by the invention herein described." The invention is portable and consists of a galvanometer, and an electric battery, one pole of which is formed by a powdered sample of the ore to be examined. The voltage of the current produced is expected to indicate the sort of ore one is dealing with. We have heard of complex ores that—but why be captious.

Who will care to go to the docks to see the "Olympic" or the "Lusitania" now? *Financial America* states that the Steel Corporation has placed an order with the American Shipbuilding Co. for two ore vessels of the Isherwood type, 600 ft. long, with a carrying capacity of 225,000 tons each. Sounds as if they were going to pick up a mine and carry it away in these ships. We shall expect to hear of a contract being awarded to Vulcan for a loading crane, unless someone kindly comes forward and chops a few ciphers off that carrying capacity.

Approximately four-fifths of the excavation required for the Panama Canal was completed on Jan. 1, 1912. According to the *Canal Record*, American engineers since May, 1904, have taken 158,010,963 cu.yd. of dirt and stone out of the canal bed. French engineers, who preceded them, had removed 78,146,960 yd., but only 29,908,000 yd. of this work was of value to the canal as rerouted. On Jan. 1 there remained to be excavated 37,230,439 cu.yd. The vast concrete construction is going on rapidly, and at the beginning of the year 75 per cent. of concrete for canal locks was in place. At Gatun locks, where work is farthest advanced, some employees have been notified that their services will soon no longer be required, though they may still find employment on other sections.

Now that the topography of the Porcupine boom resemblecs a pancake, the stable door is going to be locked by *Everybody's Magazine*. In the advertisement for the February number the announcement is made "You have been told often enough how you lost your money after you had lost it. * * * * Here you get a chance to look over the trap and size up the bait before you walk into it. * * * * In the Feburary number, *Everybody's Magazine* tells the clear cold-cut truth about Porcupine. * * * * Trailing behind the few real mines in varying stages of development are an infinity of near-mines, prospect mines and mining companies, and these, baited with the lure of real gold in the others, are being foisted on the public by all the old tricks of shady promotion—and some new ones * * * You'd better know the truth about the camp and its promotion before the harm is done instead of afterward." This was all true enough a year ago, and we presume it is interesting to review history. It is grievous, however, to see this usually uptodate magazine bringing up the rear of the procession and so busy in trying to lock the stable door now.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

The Basis of Calculating Tonnage Costs

Should tons milled or tons hoisted be the basis for calculating the yield and the cost per ton for mining operations?

Many mining companies in their annual report state the cost for mining and beneficiating on the basis of tons milled rather than on that of tons hoisted, and in the article, "Data on the World's Principal Mines," in the JOURNAL of Jan. 13, 1912, S. F. Shaw says: "Tonnage produced refers to the tons of ore actually shipped to the smeltery or treated locally, and does not include waste which was sorted out of the ore." He compiles the cost per ton for various mines from their annual reports, and for those where surface sorting is employed, this figure is, therefore, presumably per ton of ore milled. The point of basing output and cost per ton upon tons of ore milled rather than upon tons of ore hoisted seems open to discussion. For instance, at the North Star mine, in California, much waste is unavoidably mixed with the quartz in the process of breaking, and owing to the impossibility of entirely removing it, this waste must be considered as a constituent of the ore. Formerly all ore hoisted was sent to the mill. During the last year, however, from 5 to 10% of the material delivered to the mill has been removed at the crusher as waste. The question naturally arose whether to base the yield and the cost on tons of ore milled or on tons of ore hoisted. It was finally decided that the latter was the logical basis, for the reason that sorting was a form of concentration, rough to be sure, but effective, as it removed a portion of the worthless material early in the process of beneficiation.

In the recent report of the Cananea Consolidated Copper Co., published in the JOURNAL of June 24, 1911, Doctor Ricketts gives the cost for mining and beneficiating per ton of ore, including the cost of selling the refined product. A large part, however, of every ton of ore the mine produces is discarded in the concentrator, and receives no further treatment, although the beneficiating process is by no means completed at this point. Arguing from analogy, if it is correct for a mine where surface sorting is employed, to give the yield and the costs per ton milled, it would be correct for the Cananea Consolidated to state the mining and beneficiating costs per ton of concentrate produced. This figure, however, would not be practically useful, either for comparison with former years or with other properties, especially as applied to the cost of mining. Why, then, should a mine, where a certain amount of worthless material is discarded at some point in the metallurgical process, give costs on the basis of the concentrated product rather than on the basis of the ore hoisted?

Of course, in a statement of the milling operation, it should be made clear that so many tons of waste were removed before stamping, so that those interested would not be misled into supposing that the stamp duty had been miraculously increased.

WILLIAM HAGUE.

Grass Valley, Calif., Jan. 20, 1912.

Electric Railroads in California

The interurban electric railroads in California have an aggregate trackage of 1086 miles, projected and operated chiefly for the development of agricultural and horticultural fields and the improvement of real estate. Considering the area of the state and the opportunities for the development of the mining as well as the agricultural districts, this trackage is insignificant. Only a small proportion of the electric lines enter the mining districts, being confined chiefly to the dredging fields of the American, Yuba and Feather Rivers. Natoma and Folsom, in the American River districts, are connected directly with Sacramento by electric railroad. A direct electric line also connects Sacramento with Marysville, in the Yuba district, and Oroville and Chico, in the Feather River district. All these towns are also served by steam railroads, but the electric roads have had a large share in the advancement of the dredging industry commercially, and should add to the development of the quartz- and drift-mining districts by extensions into Nevada and Sierra Counties, not only directly, but by compelling extensions of steam railroads.

Nevada City and Grass Valley, two of the most important mining towns in the state, are dependent on a narrow-gage steam railroad, connecting with the Southern Pacific R.R., at Colfax, and necessitating the transfer of all freight. The development of other districts in Nevada, Yuba and Sierra Counties, commercially related to these towns, has been retarded by lack of rail transportation. Most of the camps open to profitable development are so situated as to be easy of access by rail, and especially by electric lines. The recent developments in the Alleghany and Downieville districts invite the advent of electric lines into Sierra County. One line could be economically constructed from Oroville to Downieville. An electric line from Marysville *via* Auburn, Placer County, to Nevada City, and thence to Alleghany, would give direct connection between southern Sierra County, northern Nevada County and the city of Sacramento, and would cover a large mining territory awaiting transportation facilities necessary to thorough development. Such electric extensions have been projected and talked about for several years. Until they are built and operated the mineral wealth in many of these districts will remain undeveloped. Neither the lack of mineral deposits nor the lack of water power for the generation of electricity can be offered as a reason for the failure to provide these districts with rapid transportation.

CALIFORNIAN.

San Francisco, Calif., Jan. 22, 1912.

College Men Underground

I wish to tender somewhat tardy thanks for the editorial in the JOURNAL of Dec. 30, 1911, entitled "College Men Underground." That it struck a responsive chord is indicated by the fact that practically every producing mine in the district is now following the plan outlined. In this district alone, seven college graduates whom I know personally started work along that line within the last two weeks. One of the largest iron companies has started two men within the last week, and, if successful, I am told that it will start a department for this work. Some companies are confining their attention to the breaking of ground, while others are studying all branches of underground work.

SUPERINTENDENT.

Houghton, Mich., Jan. 20, 1912.

Tantalum in the United States

In the JOURNAL of Jan. 27, 1912, there was an inquiry from "Engineer" as to where tantalum is found in the United States. In reply thereto I suggest that he communicate with Emil Hesnard, Keystone, S. D., or to E. E. Smith, Cañon City, Colo.

C. B.

New York, Jan. 27, 1912.

Dome Mines Co., Ltd.

The first report of the Dome Mines Co., Ltd., has recently been issued and contains a number of interesting features, showing the cost of opening a mine in the Porcupine district and the amount that has been spent by the company on such work up to Nov. 30, 1911. The company is organized under the laws of the Province of Ontario, and owns 240 acres of patented lands in Tisdale Township, Ont., Can., in the Porcupine mining district. This property was acquired by the issue of $2,500,000 worth of the company's capital stock at par, which was subject to a charge of $450,000, for which amount bonds of the company were issued. It is stated that under the same agreement the Monell Syndicate expended for development work, plant and betterment, the further sum of $375,000, without charge to the company. On Aug. 29, 1911, the capital stock of the company was increased by the issue of $1,000,000 worth of stock, which was offered to the shareholders of record, and was subscribed and paid for at par; the proceeds of this sale of stock went into the treasury, out of which the above mentioned bonds were retired.

STATEMENT OF OPERATIONS, DOME MINES, TO NOV. 30, 1911

Receipts	
Proceeds of sale of 99,997 shares of capital stock at par	$999,970.00
Insurance recoveries	309,236.35
Gold sales	4,276.61
Total	$1,313,482.96
Expenditures	
Plant and equipment	$672,060.28
General development	69,012.12
General charges, not allocated	57,792.82
Less accounts payable	151,120.16
Redemption of bonds	450,000.00
Total expenditures	$1,097,745.06
Balance	$215,737.90
Cash on hand Nov. 30, 1911	$202,192.63
Accounts receivable	13,545.27
	$215,737.90

Property Equipment

In July, 1911, the plant was destroyed by fire and the approximate amount of the loss, after deducting salvage, was collected as insurance and amounted to $309,236.35. The plant under construction at present, so it is stated, consists of 40 stamps with the necessary tube-mill and cyanide equipment, and is estimated will be able to handle between 350 and 400 tons of ore per day. The power house is designed with sufficient excess power to operate a mill of double this capacity. The mill, rockhouse and power house are all of steel and concrete construction and are absolutely fireproof; the storehouse and laboratory are made of steel and brick and are also fireproof. The houses of the various superintendents, foremen and miners are of brick, with galvanized-iron roofs, as are also the hospital, clubhouse and eating camp. The construction of the company's own railroad, approximately two miles long, from the Temiskaming & Northern Ontario Ry. to the mill site, has been completed. It is stated that from present indications the mill is expected to be in operation in the latter part of February.

Underground Development

Diamond drilling is said to have indicated a large body of ore of good milling grade, and this ore has been cut at various depths up to 1000 ft. W. F. Edwards, president, states that it will be necessary to do a large amount of sinking and drifting on this orebody before it will be possible to state intelligently the size of it, and what will be the average grade of the ore to be milled. It is further stated, however, that sufficient work has been done to justify the management in equipping the property with the most permanent type of buildings and machinery, with the view of extending the plant as the further development of the mine may warrant. The eight shafts in process of sinking have reached the following depths: No. 1, 72 ft.; No. 2, 45 ft.; No. 3, 50 ft.; No. 4, 35 ft.; No. 5, 175 ft.; No. 6, 145 ft.; No. 7, 200 ft., and No. 8, 102 ft. About 1310 ft. of drifting and crosscutting have been done at the 50-ft. level, and diamond drill holes have been put down aggregating a total depth of 9046 feet.

DOME BALANCE SHEET, NOV. 30, 1911

Assets		
Cost of properties		$2,575,000.00
Plant and Equipment:		
By syndicate	250,000.00	
By company	672,060.28	
General Development:		
By syndicate	125,000.00	
By company	69,012.12	
General charges	57,792.82	
Less—gold sales	4,276.61	
Less insurance recoveries	309,236.35	
Accounts receivable	13,545.27	
Cash	202,192.63	
Total		$3,651,090.16
Liabilities		
Capital Stock:		
350,000 shares, par $10		$3,500,000.00
Less in treasury		30.00
Accounts payable		151,120.16
Total		$3,651,090.16

As shown by the accompanying balance sheet, the cost of the plant, equipment and development of the property since the beginning of operations, is $860,352, after deducting $309,236, which was collected as insurance. This cost includes the $375,000 that were expended by the Monell Syndicate prior to Apr. 22, 1911, but not charged against the company. The company has obtained the services of W. W. Mein, as consulting engineer, and of Henry Hanson, associated for a number of years with the Merrill Metallurgical Co., of San Francisco, as mill superintendent.

The report shows the following men as the executive officers of the company: Ambrose Monell, president; W. S. Edwards, first vice-president; E. F. Wood, second vice-president; W. A. Bostwick, third vice-president; James L. Ashley, treasurer and assistant secretary; Alexander Fasken, secretary; F. S. Jordan, assistant treasurer, and James W. Beard, auditor. The directors are as follows: E. C. Converse, J. R. De Lamar, C. L. Denison, W. S. Edwards, Alexander Fasken, Ambrose Monell and J. S. Wilson. The head office of the company is situated at 58 Wellington St., E., Toronto, Ont., and the executive and financial departments are at 43 Exchange Place, New York.

Hollinger Gold Mines, Ltd.

After a wait of many months, the long-looked-for and first official report of the Hollinger Gold Mines, Ltd., was issued in Montreal, Que., on Saturday, Jan. 27. The pamphlet report itself is not yet available, and the following figures are those published in Montreal on that date. The report gives 462,000 tons of ore as fully and partially developed, with $10,230,000 as the total gross estimated value. Approximately 3000 samples are said to have been taken, which required the making of 8400 ft. of sample trenches. It is stated that a minimum stoping width of 3 ft. has been taken and $4 ore is considered the minimum payable grade. Conservative allowance is said to have been made for the persistance of ore beyond present workings and the estimates do not take into account a depth greater than 300 feet.

Sampling Returns

The sampling returns for Nos. 1, 2, 3, 4 and 8 veins are given as follows:

No. 1 vein, surface exposure, 950 ft.; average width, 9½ ft.; average assay value, $32.96 per ton gold. On the 100-ft. level, there is 1000 ft. of drifting in payable ore; average width, 8 ft.; average gold value, $31.54 per ton. The 200-ft. level shows 350 ft. of drifting; average width, 9⅓ ft.; average gold content, $49.30 per ton. Every additional 100 ft. of depth on No. 1 vein below 300 ft. is expected to add $2,100,000 to the profits and the continuance of other veins beyond the arbitrary depths allowed may also considerably increase the returns. No. 2 vein, exposed on surface for 300 ft., gives an average width of 7 ft.; average gold content, $7 per ton. It is stated that on this vein, crosscuts at three points on the 100-ft. level opened an additional length of 450 ft. There is a crosscut also at one point on the 200-ft. level, and 25 ft. of drifting on the 100-ft. level. This drift is said to average $20 ore over its width for the distance of 25 ft. The crosscuts are said to have shown the following grades of ore at the points cut; $7.20 over a width of 13 ft. and $16 over a width of 8 feet.

No. 3 vein, exposed for 350 ft. on surface shows an average gold content of $9.30 per ton over an average width of 5½ ft.; 35 ft. of drifting on the 100-ft. level gave $4.50 per ton over an average width of 5.2 ft. No. 4 vein, exposed for 375 ft. on surface is claimed to have given an average gold content of $11.60 per ton over an average width of 8 ft. A crosscut at the 100-ft. level of this vein showed an average width of 22 ft. and average gold content of $16 per ton over the full width. Fifty feet of drifting on this level gave $32.40 per ton across the width of the drift. On No. 8 vein an average width of 7 ft. gave $13.92 per ton over a length of 86 ft. exposed on surface. A crosscut on the 100-ft. level exposed a width of 25 ft., and a gold content of $7 per ton.

It is stated that in addition to these five veins, there are 31 veins upon which no development work has been done; that these have been exposed at intervals on the surface and thoroughly sampled.

ESTIMATED TONNAGE AND CONTENTS

Vein No.	Deepest Workings, Ft.	Estimated Tonnage	Depth Allowed, Ft.	Gross Gold Contents
1	200	210,000	300	$7,560,000
2	200	110,000	200	1,200,000
3	100	20,000	100	150,000
4	100	35,000	200	450,000
8	100	10,000	200	140,000
Miscellaneous...	...	77,000	...	730,000
Totals..		462,000		$10,230,000

The report further states that in the aggregate, the orebodies so far discovered will yield for each 100 ft. of depth, approximately 225,000 tons, containing a gross gold content of $4,000,000, from which a net profit of $2,500,000 may be expected from each 100 ft. of depth. It is also claimed that profits during the next four or five years should amount to $7,500,000 and should continue after that period. It is unofficially announced that the directors are providing for the amalgamation of the Hollinger, Miller-Middleton and Dixon-Gillies claims, numbering 15 in all; that details are being worked out and that Hollinger shareholders will participate in the new share issue.

PROPERTY EQUIPMENT

Comprehensive tests made upon the ore are said to have shown that by means of the cyanide process, a satisfactory extraction of the gold may be obtained. A 4-compartment shaft is being sunk and will be continued to the 400-ft. level. A winze is about to be started from the 200-ft. level, which will be driven to the 400-ft. level on the main vein. The total underground work accomplished amounts to 3717 ft. divided as follows: Shafts, 366 ft.; winzes, 127 ft.; raises, 82 ft.; drifting, 100-ft. level, 1289 ft.; 300-ft. level, 370 ft.; crosscutting, 100-ft. level, 1233 ft.; 200-ft. level, 250 ft. The cost of the mill, which will have a crushing capacity of about 300 tons per day, when completed, will be about $275,000 and it is expected to be in operation some time in April. The cyanide plant is being constructed with a capacity of 500 tons per day, to avoid the cost of making extensions later. The only current liabilities are accounts payable amounting to $150,403, most of which is due to the original syndicates, members of which have made the necessary financial arrangements to carry the work in hand to completion. Manager Robbins concludes his report by saying that the future of the company is positively assured.

The Porcupine Outlook

PORCUPINE CORRESPONDENCE

The present year will probably see many changes in the Porcupine district, some of them of an encouraging nature; the majority, it is to be feared, however, will bring only disappointment. A large number of the wildcats will retire to their native solitudes, while others of the more honestly managed companies will be forced to suspend work because of a lack of funds, and inability to develop orebodies of sufficient size and richness to justify further development. It is commencing to be realized that the development of a gold mine is a matter requiring a large amount of capital, combined with careful and efficient management; since the collapse of the Porcupine boom, any attempt to harvest further the usual crop of gullible investors is likely to prove a failure.

To return to the more encouraging features, it seems certain that during the present year, at least four mills will be in operation: The Dome, Hollinger, Vipond (Porcupine Gold) and McIntyre, and already one of these companies is considering an enlargement of the present estimated capacity. While predictions at this time are necessarily vague, it is quite safe to state that the output of gold for the year will be considerably in excess of $1,000,000.

As a whole throughout the camp, good progress is being made along conservative lines, and the reports on developments at the more important properties are distinctly encouraging. While mining has not been carried to any great depth, diamond drilling on several properties has disclosed the presence of orebodies at about 1200 ft. With Porcupine veins, however, the assays obtained from the cores can be considered only as indicative, and no real idea as to the value of the ore at that depth can be gained, until development work has been carried much below the present levels. An interesting feature of the Porcupine district lies in the fact that the boundaries of the ore-bearing area have not been increased to any appreciable extent, since the original staking took place. The present area is, however, large, and its possibilities are great; adequate investigation of the known properties will occupy the attention of operators for several years to come.

Old Freibergers

At a dinner of old Freiberg students held in London on June 30, 1911, it was decided to found a society to be called the "Old Freibergers," and an executive committee was elected. Since that date the rules of the society have been framed. Its object is for social intercourse and to keep the reminiscences of the old Bergakademie alive among its former students. While London is the home of the society, its members are desirous that the roll shall bear the names of many former Freiberg students not resident in Great Britain; they will welcome foreign accessions to their number, and will be especially pleased if such members can be present in London at the time of the half-yearly gatherings.

Mining engineers and metallurgists are very much "birds of passage," but London can claim to be a center through which most of them will almost certainly pass at some time in their lives *en route* to foreign fields. The committee suggests that the association in London may well be regarded, if only on account of its geographical position, as a central society to which old students of the Academy, wherever they may be, would feel it a pleasure to belong. The rules of the society provide for two dinners in London each year. It is hoped that the first will be held in March next, though the date has not yet been fixed. The object is to have it as near as possible to the anniversary of the foundation of the Freiberg School, on March 25, 1765.

The president of the association is Edward Hooper; the secretary is A. H. Curtis, whose address is 3 London Wall Buildings, London, E. C., England.

Canadian Mining Institute

A circular from the secretary's office says that the subcommittee of the Council, deputed to determine the place at which the fifteenth annual general meeting of the Institute shall be held, has reluctantly concluded to reconsider the previous decision in favor of Ottawa; and members are notified that the meeting in question will be held at the King Edward Hotel, Toronto, Ont., on March 6, 7 and 8. In explanation of its action in this regard, the committee desires to state that although definite assurance had been given of adequate hotel accommodations at Ottawa, it did not feel justified in accepting these assurances.

Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent to telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

The Disinfection of Swimming Pools

In view of the increasing construction of swimming pools by mining and metallurgical companies for the use of the men, some recent remarks on their disinfection by Norman Roberts[1] are of interest. One novelty is his suggestion that a 0.85% solution of sodium chloride be substituted for ordinary water in the pool. This solution is less irritating to the mucous membranes than any other and hence is less apt to predispose to infection.

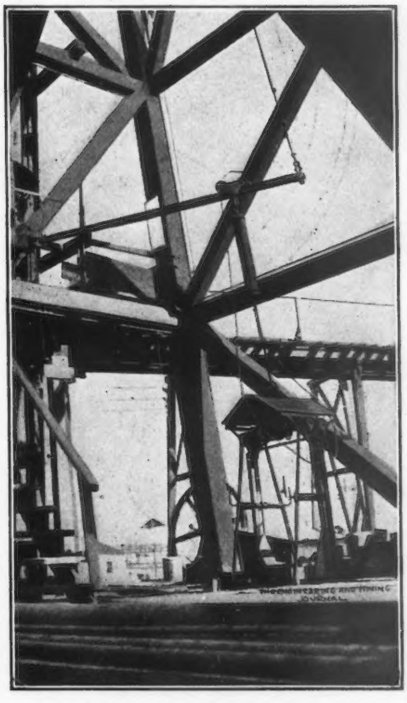
Continuous circulation and continuous disinfection are almost necessary. The first should be attained by the use of large slow-speed rotary pump. Any aëration which can be carried on by this means is an advantage, as aiding disinfection. Disinfection can be done by heating the circulation flow in a Forbes or other regenerative sterilizer, which gives complete sterilization of the treated water but is comparatively cheap, as the effluent is only from 2 to 10° above the inflow. Ozonized air and ultraviolet light can be used also.

However, none of these is as effective as disinfection by sodium hypochlorite since the first described methods simply disinfect the water treated, whereas the last disinfects all water mixed with the treated portion, as long as the hypochlorite lasts. In general, keeping the water in the pool charged with hypochlorite to the highest degree compatible with not discommoding the swimmers is indicated. A small amount of ammonia is said to increase the effectiveness of the hypochlorite many times. Occasional tests should be run for organic contamination, for even with all care, the pool may be subject to a sudden large contamination, increasing the amount of hypochlorite needed beyond all reasonable expectation.

[1]Eng. News, Jan. 11, 1912.

Air Cylinders for Changing Cages

At many shafts a small derrick is provided, as a part of the headframe, for lifting heavy objects and changing cages. At the shafts of the Tonopah Mining Company, air cylinders traveling on overhead trolley tracks are used for such work instead of derricks. Such cylinders have been described[1] as used



AIR CYLINDER ON BOOM FOR LIFTING CAGE

at the Leonard No. 2 shaft, at Butte, although in a different manner.

The accompanying illustration shows the trolley track supported from the headframe and a cylinder suspended from it. The cylinder resembles those used for lifting around the ramming machines at a converter plant. The compressed air is obtained by tapping the air main at the shaft.

A trolley and air cylinder are provided for each hoisting compartment. The tracks are so arranged that a truck can be run under the cylinder. The cage to be changed is swung on the truck, run out of the way, and a new cage run in on another truck, attached to the hoisting rope and lifted into the shaft quickly and easily. The device works admirably.

[1]ENG. AND MIN. JOURN., Aug. 20, 1910.

Uses for Old Hoisting Cable

As old hoisting cable has had most of the stretch taken out of it, it makes good reinforcement for concrete work. At the Red Jacket shaft of the Calumet & Hecla company old hoisting cable is unstranded and the strands are also used on the underground-haulage systems for the wearing ropes. In removing the grease from the cable, burning was tried, but it took the temper out of the wires and the strands would untwist, so now only a part of the grease is taken off the cables before they are unstranded.

The unstranding is done in lengths of 600 ft. A block and tackle is fastened to each end of the cable and it is stretched so that it will be clear of the ground. In attaching the blocks to the cable a clamp is used consisting of a bar with a hinged top piece which is tightened on the rope by a bolt at the other end. The block and tackle at each end is fastened to a swivel so that the cable can twist in either direction as it is being unstranded. Two strands are unstranded at a time and each of these strands is fastened to a block so that they can be kept tight as they are being unstranded. These blocks are fastened at some distance from each other as well as from the main cable, so that neither one of them will interfere with either the other or the main rope while it is being unstranded.

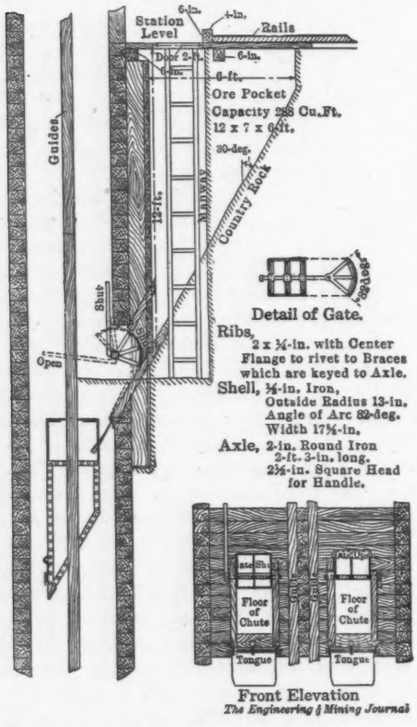
About 2000 ft. of cable can be unstranded in a day, and about 12,000 ft. of single-strand rope obtained. Both 1-in. and ⅞-in. hoisting rope has been unstranded for the haulage systems. This old rope has been found to work quite satisfactorily for the hauling rope, but good rope must be used for the tail rope if a return rope from the same engine that does the hauling is used, as the unstranded rope will not readily pass through the pulleys. Strands of 1⅜-in. rope have also been tried, but they were found to be too stiff. In case a rope breaks or a broken wire begins to ball up on the rope, the individual wire or the ends of the broken rope are heated so as to take out the temper, and then the ends are tied together and hauling is continued until the rope can be spliced properly.

This unstranded rope has been in use at the Red Jacket shaft on the haulage systems for about a year, and has been found quite good enough for the purpose at that mine. Already about 1000 ft. of old hoisting cable has been used in this way with a saving in the cost of 6000 ft. of ½-in. rope, as that was the size of rope formerly used.

Gate for Skip Loading Bins

By J. Nelson Nevins*

In the "Details of Practical Mining" of the Journal of Nov. 11, 1911, there is a description of the Cananea arc type gate that interested me, not because it was new to me, but because I think I can trace it further back. The accompanying illustration is of a similar type of gate designed by me for use in a shaft at Sombrerete, Zacatecas, Mex., in 1901, and which may be the prototype of the Cananea gate.



Skip-loading Gate at Sombrerete Mine

The arc gate and ore pockets shown in the illustration were designed for use in the Santa Marta shaft of the Sombrerete Mining Co. This was an old vertical shaft 1200 ft. deep and cribbed, near the surface, into two 3½ ft. compartments. Some ore was found in the old workings near the shaft that could not be economically extracted through any of the main shafts, so a long, narrow skip was built for the Santa Marta shaft and this ore pocket and gate were designed to fill the skip at three levels without pouring a stream of ore down the shaft. As these were built for use for only a short time the runway down from the station to the handle of the gate was omitted, and to fill the skip the station tender rode from the station to the handle on a skeleton framework on top of the skip.

The principal feature of this form of gate is that it shuts with the flow of rock, and not across or against the flow, as is usual. Also if the radius of the arc is properly apportioned to the height of the chute, it opens easily, yet the weight of the rock precludes its opening accidentally. These features naturally are more important in a shaft than elsewhere.

This gate was built in the company's shops at Sombrerete, and shortly after the gate had demonstrated its usefulness, the master mechanic and some of the shopmen removed to Cananea, where a few years later I was informed that they were successfully using this gate.

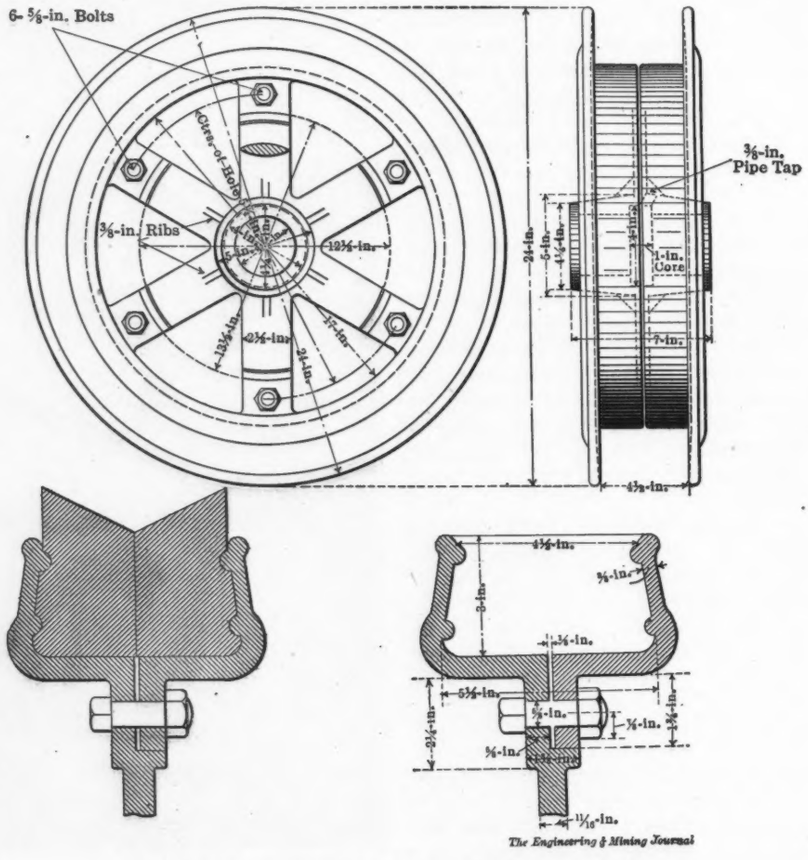
Quite recently I saw an attempt to use this idea in a copper mine in Arizona, where it had been imported from Cananea, but it was not satisfactory because the arc radius was too short for the height of the chute, so that the gate tended to lift the ore in opening.

*Mining Engineer, Pasadena, Calif.

Idler for Hoisting Rope in Inclines

In the shafts of the Copper Range Co. in Michigan which have a dip of about 70°, the hoisting ropes are carried on wood-lined idler sheaves at intervals of about 33 ft. The idler as shown in the accompanying sketch, is made of two malleable-iron castings bolted together so as to grip the wood lining pieces in the jaws of the wheel, the diameter being made 24 in. so as to increase the life of the lining. On the jaws are cast two beadings for cutting into the wood and holding it tightly.

The wood filling pieces, which are sawed so that they take the wear on the ends of the fibers on the wood, are in two pieces arranged so as to stagger the joints between the segments of each half of the lining. These segments are cut so as to have a chord of about six inches across their outer face. The wood pieces should be sufficiently thick so that when the nuts are brought tightly home on the bolts the two pieces of the frame will not quite touch. Then the bolts can be tightened so that the pieces of wood will be held securely even if they shrink considerably after being put in as happens in the case of the sheaves in the runways above ground, while in case ordinary



Idler for Hoisting Ropes Used at Champion Mine

cast-iron is used some trouble might come through the swelling of the wood as it absorbs moisture underground, in fact, that trouble was experienced to some extent at the Copper Range shafts when the idlers were made of cast iron.

Owing to the fact that the hoisting cable does not have much side play in these shafts, a face of 4½ in. on the idlers is plenty wide enough. Owing to the fact that the rim of the casting is much wider than the spokes, the bolts that hold the frame pieces together are well within the protection of the rim, so that in case the rope should slip off the idler it would not come in contact with the nuts on the clamping bolts and possibly be injured.

These idlers are carried on bearings that rest on I-beams carried on concrete pedestals coming up from the bottom of the shaft, and the whole frame is in turn protected from injury by the skip by means of wooden buffer pieces running along over the main I-beams and in turn carried on I-beam crosspieces.

Neutralizing Powder Fumes

It is stated by Stewart W. Young (U. S. pat. No. 1,011,699) that by the use of a small cartridge containing ammonium carbonate, 65%; potassium bichromate, 33%; and camphor, 2%, in holes containing high explosives, the gases will be rendered inoffensive. A somewhat cheaper composition which he also proposes (U. S. pat. 1,007,409), is a mixture of 65 parts ammonium carbonate and 35 parts of manganese dioxide.

Battery Method of Stull Timbering

By Claude T. Rice

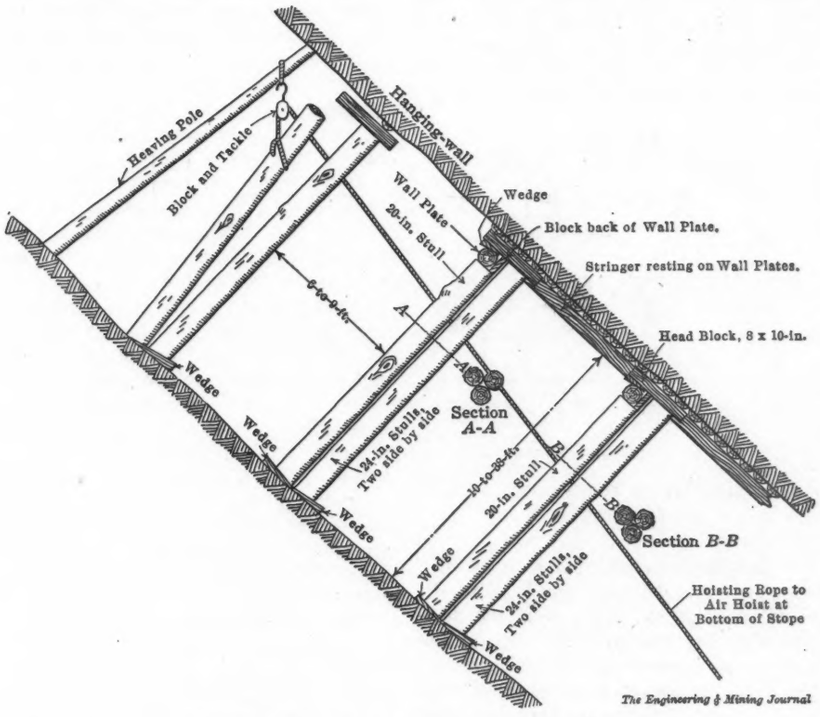
It is generally considered that stulls over 12 ft. in length have little supporting power in stopes. This is true where the ordinary method of stull or post timbering is used, but by standing the stulls in groups, or batteries, as they are called in the Lake Superior copper district, stulls can be made to support heavy roofs in stopes as wide as 40 ft. Indeed, this form of timbering has replaced the method of square-set timbering formerly used in the Calumet & Hecla mines in which the caps were parallel with and the posts at right angles to the lode.

This grouping of the stulls gives them much greater strength than the same area of timber would have if placed in one stull, while by grouping them, poorer grades of timber, and smaller and therefore less expensive sizes can be used. In the Calumet & Hecla workings where this form of timbering originated, and where it alone is used at present, the battery consists of three posts or stulls. Two are placed in the line of the strike on the lower side of the battery, while in front of the two is stood a somewhat smaller post that supports the wall plate or cap that carries the stringers over which the lagging for the roof is laced. Formerly this wall piece was a piece of square timber, but now it is made of a cheaper and stronger piece of round timber flattened at the ends where it is to rest upon the posts of the battery so as to allow the cap piece to be blocked down on top of the front leg of the battery. In case the hanging wall is good so that it does not require top lacing between the batteries, a block is put in between the front leg and the top blocking so that it can be knocked out and the wall piece put in later if necessary.

The timbers of the battery are stood directly on the foot wall, but the top blocking over them is interlaced so as to tie the group together at the top when the battery takes weight.

The posts of the batteries at the Calumet & Hecla mines range in size from 16 to 30 in., according to the width of the stope and the condition of the hanging wall. These timbers are, therefore, quite heavy, but they are easily swung into place by means of a rope from a small air hoist placed out of harm's way at the bottom of the stope, and passing up through a pulley secured to the top end of a heaving pole, which is a well tested cedar telephone pole, put in above where the battery is to be stood. The rope is fastened to the post of the battery up toward its top so that it can be lifted free of the ground and swung into place without any trouble. Then the rope is slacked off somewhat and the post allowed to swing down to where its head ought to come. One of the six timbermen in a gang then climbs up on a ladder and works in some top blocking to steady the post; then resting against the rope that holds the post he works in more top blocking. The other one of the two bottom posts of the battery is then raised up into place and the process repeated, the top blocking being interlaced over the two posts so as to tie them together. The front leg is then swung up in place and allowed to rest against the other two.

The wall piece that extends from the next battery to this one is lifted up and blocked down from on top at both ends, this top blocking being interlaced with the top blocking of the other posts of the battery. After the three posts have been blocked down from on top as well as they can be, and a sprag has been put in at the top and the bottom to catch the two lower posts of the battery and brace them from the next lower battery, so that the upper battery will not be blasted out before the weight of the hanging wall comes down on it, the last of the wedging of the posts into place is done from below where the men can get a better swing with their hammers. The wedges that are used are broad and about 18 in. wide, and are brought into the mine in bundles to permit them to be carried around easily. After the battery has been properly wedged, small stringers of round poles are put in running from cap piece to cap piece, and across this a grillage of top lacing is put in to catch the rock that scales from the hanging wall.



Battery Stulls in Calumet & Hecla Stopes

There is a division of function in the different posts of the battery. The two main legs which are put in somewhat larger than the front leg carry most of the weight of the hanging wall and they also resist the bending tendency in the posts of the battery, while the main duty of the front leg is to carry the wall piece that supports the scalings that come from the roof later in the life of the stope as well as to take some of the weight of the hanging wall. As the top post rests on the other two posts of the battery, the lower two help take care of bending strains that come on the front leg. Consequently, two shorter pieces of stull can be put in, butt to butt with a tying piece of soft 3-in. fir between them, to serve as the front leg, and this spliced stull, unless the hanging is especially heavy, serves almost as well as a stull all in one piece would, for the pressure on it is mainly longitudinal. In this way short pieces of stull that have been recovered from batteries in old stopes before they caved can be used up in the narrower stopes.

In the conglomerate stopes of the Calumet & Hecla company these batteries are put in at intervals of six feet in the direction of strike of the lode and from six to nine feet or more apart on the dip, according to the heaviness of the hanging wall in that part of the mine. After the timbering of the stope is about halfway to the level above, the size of the stulls used in the batteries is reduced for it is in the bottom half of the stope that the most weight comes. In the Hecla workings where the stopes have a width of from 14 to 16 ft. on an average a gang of six timbermen can stand and lace two batteries in a nine-hour shift, while in the Red Jacket workings where the stopes vary in width between 16 and 25 ft. and have an average width of 20 ft., and the hanging wall is not generally as good as in the South Hecla stopes, a timber gang can only stand and lace up on an average three batteries in two shifts.

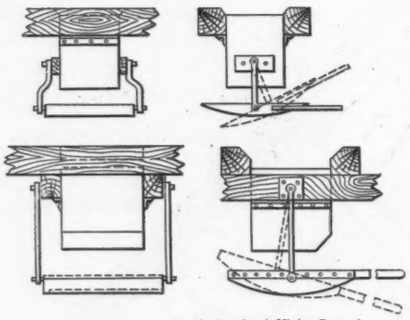
The resistance of this battery system against bending strains is amazing for in some parts of the Tamarack workings batteries are being used in stopes 42 ft. wide. In such cases foot blocking as well as head blocking is used, and in order to take care of bending stresses the three stulls of the battery are either wound with wire rope at their middle or else braced halfway down by struts from the other batteries. In this way the batteries are made to stand in such stopes for three or four months before the weight of the hanging wall becomes too great for them.

While square sets with filling would probably be found a cheaper method of supporting the walls in wide lodes than this battery system when the angle of dip is sufficient to let filling be run into them, still in veins where the dip is flat and timbering is necessary to support the walls the battery system will be found to be not only stronger but cheaper than square sets; at least that has been the experience of the Calumet & Hecla company where the weight on the roof of some of the stopes is especially great.

Gate for Vertical Ore Chutes

The gates shown in the accompanying illustration are described by L. Sanna Manunta[1] and seem to be well adapted for controlling the flow of ore or coal from pockets, the discharge openings in which are in the floor or bottom. For such work as loading cars, where the flow is intermittent, this type of gate has several advantages.

The chute consists of a square or rectangular box with flaring upper edge. The closing of the passage is effected by a swinging pan or scoop suspended from the box or the beams of the ore bin. The pan is wider and longer than the box and is suspended below it at such a distance that when the pan is in a horizontal position the angle from the horizontal of any line from the edge of the pan to the edge of the box is less than the angle of repose of the material. The operation of the pan is apparent from the sketch.



SWINGING GATES FOR VERTICAL ORE SHOOTS

When coarse ore only is to be handled the pan may hang at a greater distance from the iron box as shown by the lower figures in the sketch; for finer material, the suspension as shown in the upper figures is more desirable.

The advantage of the gate is that it can be swung entirely to one side, giving an unobstructed flow of ore. A quick downward and horizontal thrust on the long handle will bring the pan to a horizontal position under the box and stop the flow. The suspending arms and the pan must be strongly and rigidly built for the weight of the ore comes upon them as a sudden strain, and provision must be made for supporting the handle so that its weight will not cause tipping of the scoop.

[1] "Preparazione Meccanica dei Minerali."

"Don'ts" in Using Explosives

The following "Don'ts" were embodied in a lecture on explosives, delivered recently by A. E. Anderson before the mining men of Telluride, Colo. While many of them are by no means new, occasional repetition is not undesirable; if properly observed, fewer dispatches headed "Blown up While Thawing Frozen Dynamite," etc., would be seen.

Don't forget the nature of explosives, but remember that with proper care they can be handled with comparative safety.

Don't smoke while handling explosives, and don't handle explosives near an open light.

Don't shoot into explosives with a rifle or pistol, either in or out of a magazine.

Don't leave explosives in a field or any place where stock can get at them. Cattle like the taste of the soda and saltpeter in explosives, but the other ingredients would probably make them sick or kill them.

Don't handle or store explosives in or near a residence.

Don't leave explosives in a wet or damp place. They should be kept in a suitable, dry place, under lock and key, and where children or irresponsible persons cannot get at them.

Don't explode a charge to chamber a bore hole and then immediately reload it, as the bore hole will be hot and the second charge may explode prematurely.

Don't do tamping with iron or steel bars or tools. Use only a wooden tamping stick with no metal parts.

Don't force a primer into a bore hole.

Don't explode a charge before everyone is well beyond the danger zone and protected from flying debris. Protect the supply of explosives also from danger from this source.

Don't hurry in seeking an explanation for the failure of a charge to explode.

Don't drill, bore or pick out a charge which has failed to explode. Drill and charge another bore hole at least 2 ft. from the missed one.

Don't use two kinds of explosives in the same bore hole except where one is used as a primer to detonate the other, as where dynamite is used to detonate Judson powder. The quicker explosive may open cracks in the rock and permit the slower to blow out through these cracks, doing little or no work.

Don't use blasting powder, permissible explosives or high explosives in the same bore hole in coal mines.

Don't use frozen or chilled explosives. Most dynamite, except Red Cross, freezes at a temperature between 45° F. and 50° F..

Don't thaw dynamite on heated stoves, rocks, sand, bricks or metal or in an oven, and don't thaw dynamite in front of, near or over a steam boiler or fire of any kind.

Don't take dynamite into or near a blacksmith shop or near a forge on open work.

Don't put dynamite on shelves or anything else directly over steam or hot water pipes or other heated metal surface.

Don't cut or break a dynamite cartridge while it is frozen, and don't rub a cartridge of dynamite in the hands to complete thawing.

Don't heat a thawing house with pipes containing steam under pressure.

Don't place a hot-water thawer over a fire, and never put dynamite into hot water or allow it to come in contact with steam.

Don't allow thawed dynamite to remain exposed to low temperature before using it. If it freezes again before it is used it must be thawed again.

Don't allow priming, the placing of a blasting cap or electric fuse in dynamite, to be done in a thawing house or magazine.

Don't prime dynamite cartridges or charge or connect bore holes for electric firing during the immediate approach or progress of a thunder storm.

Don't carry blasting caps or electric fuses in wearing clothes.

Don't tap or otherwise investigate a blasting cap or electric fuse.

Don't attempt to take blasting caps from the box by inserting a wire, nail or other sharp instrument.

Don't try to withdraw the wires from an electric fuse.

Don't fasten a blasting cap to the fuse with the teeth or by flattening it with a knife; use a cap crimper.

Don't keep electric fuses, blasting machines or blasting caps in a damp place.

Don't attempt to use electric fuses with the regular insulation in unusually wet work. For this purpose secure special waterproof fuses.

Don't worry along with old, broken leading wire or connecting wire. A new supply won't cost much and will pay for itself many times over.

Don't handle fuse carelessly in cold weather, for when cold it is stiff and breaks easily.

Don't store or transport blasting caps or electric fuses with high explosives.

Don't store fuse in a hot place, as this may dry it out so that uncoiling will break it.

Don't "lace" fuse through dynamite cartridges. This practice is frequently responsible for the burning of the charge.

Don't operate blasting machines half-heartedly. They are built to be operated with full force. They must be kept clean and dry.

Don't cut the fuse short to save time. It is dangerous economy.

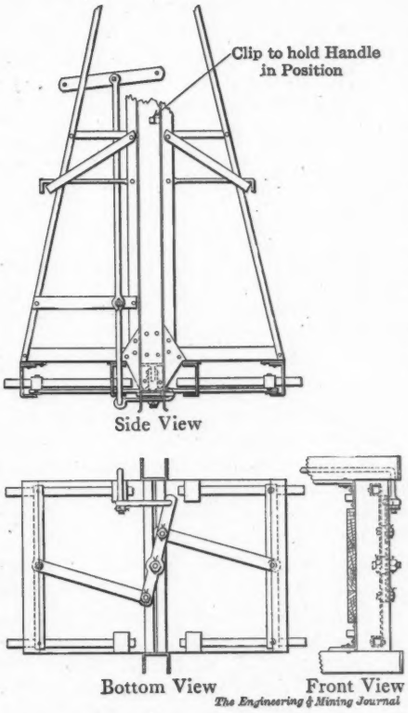
Don't expect explosives to do good work if it is attempted to explode them with a detonator of insufficient strength.

Landing Chair for Cage

BY C. L. SEVERY.*

The cage chair shown in the accompanying illustration was designed at the Poderosa mine, Collahuasi, Chile, to overcome the difficulties in the use of the ordinary kind where the timbers of the shaft were continually shifting due to bad ground. Since this chair was put into use no trouble whatever has been experienced, for as long as the cage will pass through the shaft the chairs are ready for use.

The advantages of this style of chair are many. Only one chair is needed for each cage. They are quicker to operate in changing levels and in case of accident with men aboard they can be seated



CAGE FITTED WITH LANDING CHAIRS

on any set in the shaft. This feature is convenient in shaft repair work, as the chair can be seated anywhere in the shaft and the cage held with perfect security. They add little more weight to the cage and are so simply and easily operated that boys of twelve years who can hardly reach the handle operate them here. They also can be easily attached to any cage.

The construction of the chair is simple, being a system of levers to throw out four iron rods, one at each corner of the cage, for it to rest upon, these levers being operated by another upright lever extending above the top of the car, on the cage. The four rods for seating the cage are of 1¼-inch square iron and upset at the proper point for a pin run through holes in channel irons as guides, the channel irons being riveted to the bottom of the cage. The center pivot for the levers is riveted to the middle of the T-iron on the under side of the cage. The long arm of the operating lever is made of 1 by ⅝-in. steel to pass through to give the handle the travel desired in opening and closing the cage chair. This handle is made of steel for two reasons: firstly, to make it "fool proof" against being broken off, wilfully or otherwise; and secondly, to give it the necessary spring to hold it behind a pin at the side of the cage to keep the chair from jarring open while the cage is in motion. At the upper end of the operating lever is a cross bar with a handle at each end so that it may be operated more easily from the stations on either side of the shaft.

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Safeguarding Ore Chutes

Where winzes, ore chutes or ore passes open into a floor of a drift they are a constant source of danger to the miners and trammers who have to pass through the drift. In a large mine there are usually many such openings in the floors of the various drifts and unless they are protected in some way, accidents, such as men falling into the openings, are sure to occur.

It is an excellent plan to cut all such passes so that they will open to one side of the drift or into a niche cut into one wall. In such cases there need be no opening in the floor of the drift itself, but it is not always possible to offset the winzes in such a manner. Wherever there is an opening in the floor of a drift through which miners pass, some provision should be made so that a man cannot fall into it. Preferably the opening should be closed by a gate or else by a rough grizzly of logs or timbers. Where the run-of-mine ore is coarse, it may not be possible to use log grizzlies. In such a case some warning should be given the passer-by in order to make him aware of the fact that he is approaching the collar of a winze.

At the Ray Consolidated mine in Arizona a device, similar to that used on railroads to warn trainmen that they are approaching a bridge, is employed at all places where there are openings in the floor of a drift into which a man might fall. The device consists of a beam set in the roof of the drift about four feet from the edge of the opening; one beam is used on each side of the opening. From this beam a number of heavy cords, knotted at the end, hang low enough to strike the face and shoulders of anyone who passes below it. He is thus made aware of the fact that he is approaching a winze or chute and must be careful about passing that place.

December Operations at Goldfield Consolidated

During December, 1911, the total production of the Goldfield Consolidated Mines Co. was 29,127 tons, containing $769,169, or an average of $26.41 per ton; this was milled with an average extraction of $24.76 per ton, or 94.01%. The total net income was $503,476, or $17.29 per ton. During the month 3415 ft. of development work were done.

At the Clermont, the 413 sill was extended and produced 1076 tons of $24 ore. The 495 crosscut in the hanging wall of the 420 stope is being extended in ore averaging $20. The 604-H raise from the 1000-ft. level produced 150 tons of $41.34 ore. At the Mohawk, the 3-E sill on the 150-ft. level, near the old Sheets-Ish workings, was again extended considerably, and produced 2223 tons of $23.35 ore. The sill in the K section of the 111 stope on the first level was extended, and produced 38 tons of $43.82 ore. The 293 drift on the second level produced 37 tons of $16.53 ore. The 406-X crosscut from the 495 intermediate, between the third and fourth levels, produced 218 tons of $23.15 ore. The 490-B raise, from the 495 intermediate, produced 108 tons of $23.15 ore. At the Red Top, the 353 intermediate, between the second and third levels, north of the shaft, produced 56 tons of $20 ore. The 305-DX raise, from the 353 intermediate, produced 217 tons of $35.14 ore. The 352 sill, on the third level, north of the shaft, was extended and produced 228 tons of average $29.14 ore. The third level main crosscut from the shaft is being driven across to the Laguna shaft, and a station and pocket cut at the Laguna. Upon the completion of this work the Laguna shaft will serve both mines, and the Red Top surface plant will be dismantled.

DECEMBER COSTS AT GOLDFIELD CONSOLIDATED

Mining:		
Development	$0.93	
Stoping	2.31	
		$3.24
Transportation		0.08
Milling		2.13
Marketing		0.60
General expenses		0.56
Bullion tax		0.24
Construction		0.69
Total cost of operation		$7.54
Miscellaneous earnings		0.07
Net cost per ton		$7.47

At the Laguna, the 718-ft. level of the Hazel is being driven toward the Laguna shaft, and will be connected by a vertical upraise with the bottom of the shaft. The shaft will be carried down to the 725-ft. level, and all work will then be done through the one central shaft for this section of the property. Supt. J. F. Thorn states that the total construction expenditure for December was $42,000, and that inasmuch as this construction extended over a period of several months, the total amount is not being charged off in December, but will be charged off at the rate of from $15,000 to $20,000 per month, until the total amount is cleaned up. One of the furnaces in the roasting plant has been completed and will be in operation by Feb. 1. The other will be completed within a few days.

California Oil in December

The total net production of California petroleum in December (31 days) was 7,016,896 bbl.; increase over November, 275,178 in total and 1628 bbl. in daily average. Consumption of field fuel makes the total gross production in December approximately 7,400,000 bbl. The field consumption in November was 428,429 bbl., and the average for the year 1911 was 425,000 bbl. per month. There is a considerable decrease in December and January in field fuel, owing to the substitution of electric power in many large plants.

CALIFORNIA DECEMBER OIL PRODUCTION

District	Bbl.
Fresno County—	
Coalinga	1,537,692
Kern County—	
Kern River	936,307
McKittrick	467,086
Midway	2,045,352
Maricopa	527,544
Lost Hills	38,365
Total Kern County fields	4,014,947
Santa Barbara County—	
Santa Maria	518,728
Summerland	5,300
Southern Counties—	
Fullerton	472,617
Salt Lake	225,595
Whittier	65,642
Coyote	91,521
Los Angeles	36,100
Newhall	11,240
Ventura	47,517
Total Southern fields	940,231
Total all fields	7,016,896

There was a small decrease in stocks from the amount at the end of November to that at the end of December, amounting to 734,931 bbl., the difference between 40,258,446 and 41,093,377 bbl. The December shipments aggregated 6,669,644 bbl., an increase of 350,914 over November. Records of field development in all fields showed 45 new rigs in December, an increase over November; 76 wells completed, having a total output of 13,360 bbl.; active drilling wells, 478; idle, 347; active producing wells, 5363; idle, 742; abandoned, 6. The November record showed 5268 active producing wells; 774 idle, and 17 abandoned. The net production by fields and the distribution of stocks, as reported, are shown in accompanying tables.

DECEMBER OIL STOCKS

District	Bbl.
Kern River	25,613,655
Coalinga	2,111,897
Midway	1,130,200
McKittrick	1,100,809
Maricopa	637,918
Santa Maria	667,571
Los Angeles	402,624
Fullerton	368,770
Ventura	108,725
All other fields	8,116,479
Total stocks Jan. 1	40,258,446

Mining News Via the Daily Papers

Big Gold Find

Minitonas Man Goes Wild Over the Discovery

Winnipeg, Jan. 26—Men and women and even children are flocking to Minitonas, a little town on the Canadian Northern Railroad, 268 miles west of here, for gold has been discovered there. It is thought to be the richest find in the history of western Canada, outrivaling even the Yukon fields.

For Christmas a farmer named George Elliott took into Minitonas several turkeys. Particles of gold were found in their crops. One had several small nuggets. The matter was kept as quiet as possible, while several went prospecting around the town, but without success.

Two days ago several drills were put to work, and yesterday gold in paying quantities was struck. Today five drills are at work around the town, and each one has struck gold in seams, some of it but 2 ft. from the surface. George Holroyd, a Yukon miner, started work yesterday morning with a pick and shovel. At noon he found a nugget weighing over 7 oz., and at the next shovelful he dug out a 4-oz. and a 3½-oz. nugget. Alex Mackenzie found two nuggets, each weighing about 5 oz., and many other finds have been reported in all directions from town.—*Evening Sun,* Jan. 26.

Manitoba Gold Bubble Bursts

8000 *Prospectors Had Staked Worthless Claims Near Winnipeg*

Winnipeg, Jan. 27—The gold-mining bubble at Minitonas, Man., which has been exciting the people of the country for the last two weeks, burst last night, when mining experts, at a mass meeting of prospectors, after having examined samples, announced that they had been unable to find traces of gold of sufficient value to pay for development. It is said that 8000 claims have been staked out.—*Evening Post,* Jan. 27.

Danger in the Use of Sodium Peroxide

The recent deaths of two chemists in London calls attention to a possible source of danger in the use of sodium peroxide, says the *Chemical Trade Journal,* Jan. 13, 1912. The mixture with which they were working was apparently a mixture of sodium peroxide with oil, containing some water. This water reacted with the peroxide, producing oxygen with a rise in temperature. Apparently this in turn volatilized some of the oil, which formed an explosive mixture with the generated oxygen and the outside air, which ignited either from the heat of the reaction itself or some spark.

The Slow Speed Chilean Mill

By J. B. Empson*

Many of the slow chilean mills in Mexico are crude and inefficient. For fine grinding modernized forms of this mill show better results than stamps.

Note—Excerpt from a paper read before the Mexican Institute of Mining and Metallurgy, December, 1911.

*Mining and metallurgical engineer, Apartado 1390, Mexico, D. F.

In this paper I wish to present the merits of the slow-speed chilean mill and also some data obtained from the use of a specially constructed mill now in use in Siberia. Probably the chilean mill that is now in use owes the idea under which it operates to the old arrastre which was one of the first forms of grinding machinery in use for the grinding of ore.

Changes in Motive Power

The first motive power used was either animal or water, later on to be displaced by steam engines to some extent, which in its turn gave way in some districts to electric power. I mention these various stages of power in order to show that the transmission gear that was used with the steam and water power should be changed to conform with the needs of the fast-running electric motor. The positive jaw clutch which could be used with success with a steam or water installation is an element of great danger for breakage of parts when used in conjunction with the electric motor. The slow speed of the mill and the more or less heavy torque at starting of all chilean mills must give an enormous strain on the gear moved by such a fast-running machine as a motor. Of course all this can be overcome by installing the proper transmission machinery according to the type of motive power available, but I believe that such simple things as these have in a way hindered the slow-speed mill from taking the place in modern metallurgy that it deserves.

Though much has been written as to the merits of the slow-speed chilean mill it would appear that this type of mill has been installed in but few of the modern mills either in Mexico or in the world generally. There are probably three reasons for this.

First. Mining Companies are too often influenced by the machinery sellers, who do not care to specialize in slow-speed chile mills but whose profit in stamp mills and their accessories is much larger than it probably would be in such a simple machine as the chile mill.

Second. The types of slow-speed chile mills at present operating in Mexico while they are efficient along certain lines are devoid of the necessary mechanical features to bring their work up to the point of efficiency to be desired.

Third. It is possible that engineers have been too conservative and in their efforts to protect their clients from experiments, have followed too closely behind those who believe that with heavy stamps and tube mills the last word in economical milling has been said.

Coarse crushing with heavy stamps appears to be an inefficient way of reducing ore from 1½ or 2 in. to ¼ in. or less. Then 1550-lb. stamps should crush about 150 tons of average ore per 24 hours consuming about 35 hp. A set of rolls 16x36 in. reducing ore from 1½ in. to ⅜ or ¼ in. will use about 20 hp. These are of course approximate figures depending on the hardness of the ore, etc. I think that I am right in saying that the cost of the installation of the rolls will be about 30% of that of stamps.

The objection made to the use of rolls in the past was that they were too difficult to keep in order. Difficulties in the alignment, bearings and in keeping the shells from corrugating have kept prospective users from investing. However, I believe that the present design of rolls has almost if not entirely eliminated most of these objections, and the fact remains that some of the cheapest crushing costs in the world today are in some of the large copper concentrating mills that are operating in the United States. I have gone a little into the question of rolls versus stamps in order to prove that rolls can easily compete with stamps under certain conditions, and that as a coarse crusher ahead of chile mills it has a field in which it would compete only with the secondary crushers.

First Cost of Chile Mills High

The types of chilean mills with which I am familiar are extremely crude both in the method of applying the power as well as to the impossibility of preventing the grit from entering the bushing in which the trunnion shaft turns, causing an altogether needless expense in the upkeep. The mills in use at La Union in Pachuca and at El Bote, Zacatecas, are of a different type to those above mentioned and are far superior in every respect. The main reason, I understand why these latter types of mills have not come into more general favor is that of first cost, which, if my information is correct, is excessive; probably owing to their great weight the question of freight and duties plays an important part.

There are several claims to be made in favor of the chilean mill in Mexico as compared with stamps, especially on small installations. People who argue in favor of stamps base their claims on the following or similar points; simplicity, ease with which repairs can be made, small space occupied, operation in units, availability of men who are familiar with their operation. Much can be written in favor of stamps especially as applied to ores which do not call for reduction to slime, but on which leaching of sand is possible. Under conditions where ore is to be crushed to ¼-in. mesh in stamps and reduced to 30 or 40 mesh in tube mills, the slow-speed chilean does not compete.

High Efficiency in Fine Grinding

The slow-speed chilean is essentially a fine grinder and as such can show a mechanical efficiency that cannot be obtained by stamps and tube mills. Hence its application to Mexican conditions where the latest metallurgical practice is to grind silver ore so that not more than 20% will remain on a 200-mesh screen. To do this work with stamps entails the installation of one tube mill to each five stamps when each stamp weighs 1250 lb. Putting these at their maximum capacity of 10 tons per stamp according to Mexican practice gives results as follows: 10 stamps, 1250 lb. each, 100 drops per min. require 27 hp. or 2.7 hp. per stamp. On a basis of 100 tons and deducting 10 tons for slime in batteries the charge to each of two tube mills is 45 tons. Then allowing two 5x16-ft. tube mills to do this work the rated running power required for each mill would be 46 hp. The total power required is, therefore, 119 hp. or 1.19 per ton. Tube mills require approximately 1 hp. for every ton ground to 200 mesh. To do the same work with slow-speed chile mills would call for an installation of four chile mills requiring 15 hp. each to crush about 25 tons per mill per 24 hours to an estimated degree of fineness shown by the following figures published by Mr. Megraw on work done at the Santa Elena mill at San Luis de La Paz: On 60 mesh, 1.15%; on 80 mesh, 5.65%; on 100 mesh, 0.15%; on 200 mesh, 25.75%; through 200 mesh, 67.30%.

This is stated to be an average result. Hence it is seen that in crushing 100 tons of ore by this method the amount to be reground is 34.75 tons of which only 8.95 tons can be classified as being coarse. To do this work would take a 4x16-ft. tube mill using 27 hp. at rated running,

making a total of 87 hp. for the whole installation equivalent to 0.87 per ton of ores crushed to 200 mesh. Naturally the finer the product given to the tube mill to crush the greater will be the output of the mill. From experience gained from an installation of this kind it has been shown that the difficulty is to give the tube mill enough work to do in order to allow it to work efficiently. From the figures as given above it will be seen that with the chilean mill installation there is a saving of 0.32 hp. per ton as compared with stamps and tube mills.

Stamps vs. Chilean Mills

An extremely interesting comparison was made recently by W. H. Urbiter[1] between stamps and tube mills and slow-speed chilean mills. Mr. Urbiter in reviewing the situation gives figures as follows: Santa Elena, San Luis de La Paz, slow-speed chilean mills 2-roller type, 67.3% through 200 mesh; 1.84 tons per hp.-day; mechanical efficiency, 49.09%. Hacienda La Union, Pachuca, same as above; 80% through 200 mesh; 1.70 ton per horsepower day; mechanical efficiency, 46.13%. South Africa, heavy stamps and tube mills; 90% through 90 mesh; 1.53 tons per horsepower-day; mechanical efficiency, 40.48%.

Putting the South African practice on a par with Mexican practice, it would appear that if the South African mills were crushing to the same fineness as those in Mexico the relative mechanical efficiency would be much lower.

In American practice the three-roller fast chilean mill gives the following: 39.4% through 200 mesh; 2.35 tons per horsepower day, mechanical efficiency, 55.73%. Owing to the relatively small amount through 200 mesh, it will be seen that this class of mill when crushing to the same degree of fineness as the mills in Mexico would lose to a large extent its relatively high mechanical efficiency.

From the above figures it will be seen that when the fineness of the final pulp is taken into consideration, it is evident that the slow-speed chilean mill is a much more efficient machine to reduce ore to the required fineness as demanded by Mexican practice than any of the other combinations.

Comparative Costs Favor Chileans

Itemized costs per ton of ore ground, as published by Mr. Megraw on actual work done at the Santa Elena mill, are as follows: Labor, 0.03 pesos; lubrication, 0.01 pesos; power, 0.288 pesos; tires and dies, 0.129 pesos; extra repairs, 0.010 pesos; total, 0.467 pesos; Mr. Narvaez of La Union mill in Pachuca gives a cost of 0.558 pesos for reducing ore so that 80% will pass a 200-mesh screen. At the Santa Elena mill the ore is crushed so that 67.3% passes 200 mesh. Against this the cost of grinding a ton of ore to approximately the same fineness by the use of stamps and tube mills will range from 65 centavos to over a peso per ton according to the size of the mill and nature of power used. In these figures there is no allowance made for depreciation either in chilean mills or stamps; nor is there any allowance made for crusher power, this being the same in either case.

When one is confronted with figures such as these it must be evident to the most casual observer that either there must be great scope for improvement in the stamps and tube-mill work as at present carried out, or that through ignorance and prejudice the slow-speed chilean mill has not received the attention that apparently it deserves at the hands of engineers. On considering the matter I believe that it will be generally admitted that in the majority of cases the stamp and tube-mill work as carried out in Mexico in large installations is on the whole excellent, hence we have no other excuse than to say that we as engineers have failed to credit the slow-speed chilean with the numerous advantages that as far as I can learn it is entitled to.

I am not presenting this paper with the idea that I am suggesting any new idea to the mining fraternity, as of course we have all known for some time, that this form of mill has had merit. My aim is rather to suggest that on the latest results accomplished by a modernized form of this mill we cannot afford to shut our eyes to such a great difference in costs as apparently exists between the use of stamps and tubes as compared with the chile mills.

The following are some of the apparent benefits to be gained by the use of chilean mills as compared with stamps. Less height required; cheaper foundations; fewer repair parts required; ability to withstand the roughest handling; breakdowns and hence delays less than stamps; over feeding or under feeding does not hurt the mill; in some cases absence of all screens; absolutely unskilled labor can operate it; attendance if mechanical feeders are used is small; repairs to nearly every part can be made on the ground; minimum vibration and hence minimum depreciation of mill; steel wearing parts will last from 18 months to two years.

Doubtless there are other points which could be mentioned but I think that with the above sufficient has been said to show that more attention should be paid in the future to this type of mill.

Slow Chileans in Siberia

At a recent meeting of the Institute of Mining and Metallurgy, D. C. Bayldon read an excellent paper on the results accomplished in Siberia using a modernized form of slow chilean mill and from the discussion that this paper produced there was evidently considerable interest taken in the matter. The consensus of opinion apparently was that for all-sliming this form of chilean mill has a large field, but in South Africa where the practice is to grind to 30 or 40 mesh it would not apply. It cannot be too strongly emphasized that this type of chilean mill is a slimer and not a coarse crusher even as far as 30 mesh.

DATA OF SLOW CHILEAN MILLS OPERATING IN SIBERIA

	No. 1	No. 2	No. 3	No. 4	No. 5
Number of chilean mills	6	4	6	6	6
Number of runners per mill	2	2	2	2	2
Diameter of pan on bottom	7.6	8.9	8.2	10.6	9.4
Distance between runners, feet	6	6.9	6.6	8.3	7.6
Width of runner face, inches	10	10	10.5	10	12
Diameter of runner, feet	5.5	5.5	5.5	5.5	6.6
Weight of runner	5400	5400	5400	5400	10,800
Speed, r.p.m.	12	14	13.5	12	11
Travel of runner, ft. per min.	226	297	275.6	311	260
Height of discharge, inches	10	10	9¾	9½	8
Screen used	1 mm. slot	1 mm. slot	¼ punched	1 mm. slot	½ mm. slot
Water to ore ratio by weight	10:1	6.5:1	7:1	13:1	.....
Duty per 24 hr., tons	16	26	20	19	24

The old type of chilean mill which has been used in Siberia for years is similar to that in use in Mexico with the exception of a few points. The trunnion shaft in most cases is keyed solidly to the boss of the runner. The boss is provided with an annular recess for the reception of compensating weights when the tire becomes worn. The center bearing containing the trunnion shaft is movable vertically so as to allow the runner to accommodate itself to variations in the hight of feed.

Mr. Bayldon gives the particulars of some typical plants crushing ore similar in hardness and general character as shown in the accompanying table. Most of the mills are hand fed with ore broken to any size up to 4-in. ring. The power is estimated at from 7 to 12 hp. per mill. These mills are run solely for purposes of amalgamation. The percentage of amalgam collected directly from the mills averages 84% of the total recovered. The average result of screen tests on four of the above mills was: On 30 mesh, 0.22%; on 60, 5.44%; on 100, 15.14%; through 100, 79.44%.

The product is extremely fine and

[1]Eng. & Min. Journ., Aug. 5, 1911.

of uniform even grade. The mills were designed with the idea of avoiding violent agitation of the pulp in the pan. Mr. Bayldon sums up the work of these mills as comparing most unfavorably with stamps on an output basis, in respect to power, space occupied and first cost.

Bayldon's Improved Chilean

From experience gained in the operation of this old type of mill, Mr. Bayldon designed a modern mill of the same type concerning which he gives the following information, taken from actual working results: diameter of pan, 10 ft. 3 in.; distance between center of runners, 8 ft. 6 in.; revolutions of mill per minute, 14 and 16; mean runner travel per minute, 340 and 427 ft.; diameter of runner 72 in.; width of face of runner, 12 in.; weight of runners, each, 10,000 lb.; weight of tire alone, 6040 lb.; weight of die set, 4880 lb.; size of discharge opening 44x8 in.; gross weight of mill, 23 tons.

In an installation of six of these mills, the power to drive same is supplied by two 50-hp. motors. Three of the mills are run at 14 r.p.m. and three at 16. The capacity of the mills at present is limited to about 39 tons each, any output beyond this causing excessive overload. A screen analysis of the ore fed to the above mills follows: On 3-in. square, 5.7%; on 1½ in., 42.5%; on ¾ in., 27.6%; through ¾ in., 24.2%.

In the mills running at 14 r.p.m. it was found that a height of discharge of 9 or 10 in. and a water ratio of 4.5:1 to 5.5:1 with 1-mm. screens gave the best results. The water is regulated to form a thin layer about 1 to 1½ in. in depth immediately behind the runner and advances in front in a high wave. The product from a mill at 16 r.p.m. is slightly coarser than at 14 r.p.m. Mr. Bayldon gives the mechanical efficiency of the mill using the above mentioned ore feed and crushing through 1-mm. screen as 63.09%. With ½-mm. screen the efficiency is 63.97%. The net wear of tire and dies is estimated at 0.63 lb. for tires and 0.28 lb. for dies or 0.91 lb. total net consumption of steel.

Mr. Bayldon summarizes as follows: The mill is an extremely simple crushing machine requiring no skilled supervision and little attention and is almost foolproof. Temporary failure of the feeder has no other effect than to reduce the capacity of and power taken by the mill which is in marked contrast to stamps. The mill produces a product of uniform fine even grade and its mechanical efficiency as compared with stamps, producing in one operation a similar finely ground product, is vastly superior. The most suitable water to ore ratio by weight with these mills is low and compares favorably with that of stamps.

The most suitable capacity at 14 r.p.m. may be taken at 42 tons per 24 hours. At the higher capacity of 51 tons the mill is overloaded. The mill at 16 r.p.m. could be run for a capacity of 50 tons and at 20 r.p.m. for from 60 to 65 tons. If this mill were converted into a three-runner which could be done at little expense or trouble the capacity could be increased about 50%. The mill, however, as it stands compares favorably with stamps on a tonnage basis in respect to space occupied and in initial cost and erection the advantage is also with the former.

A Modernized Chilean for Mexican Use

I was so impressed with Mr. Bayldon's paper as confirming to a certain extent the local practice in this type of mill, that in conjunction with another engineer I have attempted to combine the best features of the Mexican practice with those now existent in the mills of Siberia in the form of a modernized chilean mill. Our idea is not to ask for any patent as we have nothing really to patent, as the ideas which this mill embodies are those taken from existing practice.

We propose to have this mill manufactured locally, especially such parts as the heavy cast-iron castings, leaving for import only such parts as the steel wearing parts and such other parts which at present may be beyond our local capabilities. In this way we hope to be able to reduce the initial cost of the mill so as to be able to place it on the market at a reasonable figure. We understand that the high first cost of the imported chilean mill has been in the past one of the principal reasons why this mill has not received more attention. Our chief aim in the design of this mill has been to keep it as simple as possible and also not to add to the cost of the machine by specifying any expensive parts, but at the same time to allow of an ample factor of safety for any parts that may be liable to breakage or abuse.

The essential changes that we have endeavored to introduce are as follows: (1). Improvement in the method of applying power to the mill. (2) Complete change in the form of pan used. (3). The trunnion shaft turns in a center bearing and not on the boss of the muller, where it is subject to grit dripping down the side of the muller and cutting out the bushing in which the shaft turns. (4) Device for allowing the mullers to lift independently over any unbreakable object. (5) Improved method of feeding the ore. (6) More screen discharge with which either the overflow method or screens can be used. (7) Adjustable chuck blocks.

Mantey Offset to be Used

We have embodied the adjustable Mantey offset as we believe that this device is of much benefit in the work of the mill. The muller besides revolving is given a dragging movement across the die by this offset. We have estimated the capacity of our proposed mill at 40 tons per day of 24 hours. We see no reason why this mill should not at least equal that in actual use in Siberia, as it is slightly heavier and at the same time embraces the use of the Mantey offset. Mr. Bayldon describes the ore on which his mills are operating in Siberia as a fairly tough quartz quite equal in hardness to the average commonly met with in gold mining the world over, and comparable in toughness and hardness to the Rand banket.

We estimate that the mill will require 17 to 18 hp. to do this work but allowing 20 hp. in order to be safe it only gives 0.5 hp. to reduce a ton of ore to practically 100 mesh. Taking Siberian practice as our guide we find that with a capacity of 39 tons per day and with a water to ore ratio of 4.8:1 the ore ground fine enough to pass 100-mesh screen is 78.26% and of the balance 16.37% will pass a 60-mesh screen but stays on 100 mesh leaving only 5.37 as the percentage on 60 mesh. From these figures we estimate that the installation of one tube mill say 5x20 ft. will be sufficient to take care of the oversize of three chilean mills, which gives the power consumption as follows: Three chilean mills, 60 hp.; one tube mill, 32 hp.; total, 92 hp.; or 0.766 hp. per ton of ore ground.

We submit the idea of the feed hopper revolving with the mill so as to spread the feed equally over the entire surface of the die ring. This we have taken from the practice of the fast-running chilean mills whose makers claim that when this system of feeding was introduced the capacity of their mills was increased 25%. If no other object has been attained by our efforts than that of promoting discussion of the merits or otherwise of the proposed innovation, we shall consider that our efforts have not been useless.

Mount Lyell Report

In the abstract of the Mt. Lyell Mining & Ry. Co.'s annual report, in the Journal of Jan. 20, 1912, p. 154, the words "costs per ton of blister produced" should read "costs per ton of ore treated." The total cost per ton of fine copper was $207.15, of which $94.38 was for mining; $98.68 for smelting, and $14.09 for converting. Figured per lb. of copper, the cost was 9.24c., of which 4.21 was for mining; 4.41 for smelting; and 0.62c. for converting. The average selling price was 12.39c. per pound.

Nevada Consolidated Copper Company

The report of the Nevada Consolidated Copper Co. for the quarter ended Dec. 31, 1911, shows that 15,434,788 lb. of copper were produced. For the purpose of comparison the following figures of production are given: last quarter of 1910, 15,698,595 lb.; first quarter of 1911, 15,893,743 lb.; second quarter, 15,677,065; third quarter, 15,837,079 lb.; October, 1911, 5,547,131 lb.; November, 5,207,983; December, 4,679,674 lb. The production for December, 1911, was lower than any previous month in the 15-month period. This was due to unusually severe winter conditions.

The copper contents of the ore treated in the quarter are reported as 1.94%. The surplus earned amounted to $202,-264, after payment of the ninth quarterly dividend of $749,389 and charging off $136,991 for Steptoe plant depreciation.

The Veteran mine, the fee of which was purchased from the Cumberland-Ely Copper Co. in August, 1910, was reopened during the quarter, after having remained closed since July 1, 1909, owing to a strike of the miners. The production of ore was limited, operations being confined to necessary repairs to shaft and surface works, to cleaning up the sub-level drives, which had caved, and in general preparations for enabling full tonnage to be mined as quickly as possible.

The Last Word on the Potash Settlement

A circular issued by the International Agricultural Corporation, under date of Jan. 22, says:

Shortly after organization, in July, 1909, the company acquired the entire capital stock of one of the largest potash mines in Germany, Kaliwerke Sollstedt Gewerkschaft, for which it paid in stock of your company as follows: Preferred, $2,500,000; common, $1,500,000. As a result of its 2½ years' ownership of Kaliwerke Sollstedt Gewerckschaft, the company has received therefrom by way of dividends, from Sollstedt debentures paid to it as a consideration for its surrender of the seven-year potash purchase contract, from Kaliwerke Aschersleben as purchase price for one-half of Sollstedt shares, and from other sources resulting from the potash settlement, an aggregate cash amount in excess of $4,500,000. Taking into consideration the cash it has already received from the above-mentioned debentures, your company has given to Kaliwerke Aschersleben the option to purchase its remaining one-half of Sollstedt shares at a cash price of $1,500,000. Since the enactment of the recent German potash law, regulating prices and production, the ownership of an independent mine in Germany offers no particular advantages to American fertilizer manufacturers, and for this reason your company decided that it could use the funds which it had invested in Sollstedt before the passage of the law more advantageously in the expansion of its American fertilizer business. The settlement gives to the company not only the cash as above set out, but also provides for the settlement, without expense to it, of all pending litigation pertaining to its potash contracts, which naturally resulted from the passage of the German potash law, and also secures for your company its requirements of potash salts on a basis guaranteed to be as favorable as may be obtained by any other American buyer of potash.

E. R. Buckley

The many friends of Dr. and Mrs. E. R. Buckley will be grieved to hear of his death from pneumonia at Chicago, Jan. 18, followed by the tragic death of Mrs. Buckley. Those who knew the ideal happiness of their married life will not be surprised to learn that she was unable to recover from the shock caused by the loss of her husband.

Doctor Buckley graduated from the University of Wisconsin in 1895 with the degree of B.S., to which was added that of Ph.D. in 1898.

During the practice of his profession as a geologist he served upon the State Geological Survey of Wisconsin, and for seven years was State Geologist of Missouri and director of the State Bureau of Geology and Mines, at Rolla, Mo. He then entered the service of the American Smelters Securities Co. as geologist of the Federal Lead Co., Flat River, Mo., where he was engaged for several years in conducting its exploration work. Withdrawing from this a few months ago he began general consulting practice as a mining geologist with offices in Chicago.

Doctor Buckley was a member of various scientific and technical societies, and was especially active in the work of the American Mining Congress, having been president of that organization and a director at the time of his death.

He was a frequent contributor to professional journals and was the author of various works and reports, the best known of these being the "Geology of the Zinc and Lead Deposits of Granby, Southwest Missouri" and the "Geology of the Disseminated Lead Deposits of St. Francois and Washington Counties, Missouri."

The attainments and character of Doctor Buckley call for more than this formal record. To that record we wish to add that he was not only prominent and successful professionally but was influential as a man.

This was due to a high character and strong personality; and also to his active interest in public affairs and the general welfare of the mining industry.

It seems to us that in summing up the record of a man's life these latter qualities far outweigh the others. No one can live to himself alone, and the man who not only does his professional work well but also plays his part in the world of men, trying to make things better, is an inspiration to all.

Wet Assay of Copper Mattes

By Donald M. Liddell

In the assay of low-grade copper mattes by the ordinary combination wet-and-fire method, i.e., dissolving the matte in nitric acid, trouble is often experienced from the large amount of ferric oxide and unoxidized sulphur left after the action has ceased. In some cases there is so much ferric oxide as to render scorification of the residue impossible. An easy way to avoid this, although requiring some extra manipulation and time, is to treat an assay ton of the matte worked upon with about the theoretical quantity of dilute sulphuric acid necessary to dissolve the iron present, warming gently. When action has ceased, filter by decantation through a double filter. By this means two sources of trouble are simultaneously removed, the sulphur which is combined with the iron goes off as H_2S, the iron goes through the filter paper as $FeSO_4$.

The residue is then treated with HNO_3, in the same beaker, just as for the ordinary combination assay, except the acid is diminished to suit the small mass of residue remaining, and the same filters are used for the second filtration after the silver is precipitated. I have often tested the iron filtrates for silver, but have never found any; apparently the H_2S precipitates any silver or copper dissolved.

It is also worth remembering with some leady mattes that very dilute HNO_3 decomposes PbS with evolution of H_2S.

Farrell on Steel Prices

Before the Stanley committee, President Farrell of the Steel Corporation said that he would not object to publication of composite costs of making iron or blooms but would object to publication of costs of more finished products. Competitors would estimate bids of the corporation to a fraction before they were opened.

He asserted that manufacturers did not go into the question of costs even at the Gary dinners. It is the smallest manufacturer who makes the market. It is a mistake to suppose that the Steel Corporation makes the market. "If some one offers to sell an article at $1, we cannot sell at $1.25. The Republic company made its reduction because it expected to accomplish a reduction of 15% in wages, and it was surprised that other companies did not follow suit. The Republic has since been advancing its prices of its own volition because it found its cut rates unremunerative."

Mr. Farrell evidently has a clearer idea of what governs prices than Judge Gary possesses.

The Geology and Mining of Clay

By Edgar K. Soper

The formation and classification of clays and the methods of mining are discussed. The processes for making brick, the most important clay product, are also briefly reviewed.

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Clay, which is one of the most widely distributed materials of economic value occurring in nature, may be defined as "a fine grained mixture of the mineral kaolinite with fragments of other minerals, such as silicates, oxides, hydrates and often organic compounds; the mass possessing plasticity when wet, and becoming rock hard when burned at least to a temperature of redness."[1] The most prominent property of a clay is its plasticity and it is due to this characteristic that clays may be molded into almost any desired shape, which they retain when dry. Furthermore, it is this plasticity that distinguishes a clay from certain varieties of shales, marls, and earthy mixtures.

Origin and Classification

Clays are always of secondary origin and are formed from the decomposition of other rocks. A very pure clay or kaolin is one consisting almost entirely of the mineral kaolinite, which is derived from the weathering and decomposition of feldspathic rocks. For this reason many geologists formerly intimated that all clays were due to the decomposition of rocks containing much feldspar. But it has been proved that some of the most plastic clays are directly derived from rocks such as serpentine or gabbro, which contain little or no feldspar.

There are many kinds of clays and many different processes are responsible for their accumulation. Several schemes have been suggested by various writers for the classification of these clays, some based on method of accumulation, and others upon the properties and characteristics of the clay, or upon both. One of the latest classifications based on properties and uses of clays is that suggested by Grimsley and Grout, and is given below.

Grimsley and Grout's Classification

I. Residual Clays:
- (1) Kaolin.
- (2) China or porcelain clay.

II. Transported Clays:
- (A) Refractory (fluxing impurities low).
- (3) Flint fireclay.
- (4) Plastic fireclay.
- (B) Semi-refractory clay (fluxing impurities medium).
- (5) Paving-brick clay and shale.
- (6) Sewer-pipe clay and shale.
- (7) Roofing-tile clay and shale.
- (8) Stoneware clay and shale.
- (C) Non-refractory (fluxing impurities high).
- (9) Pottery clay.
  - (a) Ball clay.
  - (b) Flower-pot clay.
- (10) Brick and tile clay and shale.
  - (a) Ornamental-brick clay and shale.
  - (b) Terra-cotta clay and shale.
  - (c) Ornamental-tile clay and shale.
  - (d) Common-brick and tile clay and shale.
- (11) Gumbo ballast clay.
- (12) Slip clay.

Perhaps the best classifications, from the point of view of the prospector, is that suggested by H. Ries and is based on method of accumulation and physical properties. This classification is as follows:—

Ries Classification

I. Residual clays (by decomposition of rocks in situ).
- (1) Kaolin or china clays (white burning).
  - (a) Veins derived from pegmatite.
  - (b) Blanket deposits derived from extensive areas of igneous and metamorphic rocks.
  - (c) Pockets in limestone (as indianaite).
- (2) Red burning residuals (from different kinds of rocks).

II. Colluvial clays, representing deposits formed by wash from the foregoing, and of either refractory or non-refractory character.

III. Transported clays.
- (1) Deposited in water.
  - (a) Marine clays or shales (deposits often of great extent).
  - (b) White-burning clays. Ball clays.
    Fireclays or shales; buff burning.
    Impure clays or shales; calcareous and non-calcareous.
  - (c) Lacustrine clays (deposited in lakes or swamps).
    Fireclays or shales.
    Impure clays or shales; red burning.
    Calcareous clays, usually of surface character.
  - (d) Flood plain clays, usually impure and sandy.
  - (e) Estuarine clays (deposited in estuaries); mostly impure and finely laminated.
- (2) Glacial clays found in the drift and often may be red or cream burning.
- (3) Wind-formed deposits (some loess).
- (4) Chemical deposits (some flint clays).

The chemical changes involved in the alteration of orthoclase feldspar to kaolinite are probably represented in the following equation:—

$$KAlSi_3O_8 + H_2O = KOH + HAlSi_3O_8$$

The $HAlSi_3O_8$ formed is unstable and may lose some of its quartz (SiO_2), resulting in the formation of kaolinite which probably constitutes an essential part of most clays. Thus it is seen that the primary source of all clays is in the decomposition of the rocks.

Residual Clays

Where a clay is found overlying the rock from which it was formed, it is termed a residual clay, for it represents the residue from the decay of that rock. No matter what that rock may be, the weathering begins at the surface and gradually works downward. This will result in a gradual transition from clay through a mixture of clay and rock, to unaltered rock, as we pass from the surface downward. The contact between the altered clay and the unaltered rock is usually irregular and indistinct. Where cracks, joints, or porous strata exist in the rock, the weathering agencies are able to penetrate to greater depths than where the rock is hard, compact, and free from cracks.

As granite weathers, the feldspar decays, and the rock is gradually converted into a clayey mass. Pegmatites, which may be compared to very coarse-grained granite, are often altered to almost pure kaolinite near the surface, resulting in veins of white-burning kaolin clay. These are especially liable to be found in the southern Appalachian region. When a limestone weathers, the action is different from that in the case of granite. Limestone is a rock composed largely of $CaCO_3$, or carbonate of lime and mag-

[1] H. Ries, "Economic Geology," 1910, p. 124.

nesia, always with a variable quantity of clay impurities. In the process of weathering, the soluble carbonates are dissolved and the insoluble clay impurities are left behind as a residue, forming a mantle over the unaltered limestone beneath.

A residual clay formed directly from the decay of feldspar is called a kaolin, and it is made up almost entirely, when pure, of the mineral kaolinite. Kaolins are usually white burning, and are used extensively in the manufacture of chinaware.

The forms which residual clay deposits may assume will depend upon the form of the parent rock. Clays derived from the breaking down of large masses of granite will be distributed over large areas, while pegmatite veins will give rise to long, narrow, tabular deposits. Limestones may form residual clay deposits of considerable horizontal extent, but of irregular depth. In general, the depth will depend upon the climate, topography, and situation.

Clay derived from rock having much iron oxide in it, will be yellow, red or brown, depending on the iron compounds present. Residual clays are found in many portions of the United States, but the richest field is that lying east of the Mississippi River and south of the southern margin of the ice sheet of the glacial epoch.

Sedimentary and Aeolian Clays

Sedimentary clays are derived from residual clays, which seldom remain long on steep slopes, but become washed away in rain storms and carried into streams where they may be transported to distant areas. In this manner, residual clays of entirely different nature may be washed into the same stream, where they become mixed. Later, when the stream deposits its burden of silt and clay, these mixtures of different residuals form deposits of sedimentary clays. All sedimentary clays resemble each other in being stratified, and this stratification is the best means of distinguishing them from the other varieties. Another important difference is the fact that they usually bear no genetic relation to the underlying rock upon which they rest.

In some regions of the West there are found deposits of silty, fine, calcareous clays termed loess. These are usually stratified water deposits, but they may be formed by wind action alone.

Secondary Changes in Clay Deposits

After clay deposits have been formed, various geologic agencies begin to act upon them to produce the secondary changes which are so often observed. These changes may be either mechanical or chemical.

In excavating clay beds, it is not uncommon to find streaks of sand extending down into the deposit, cutting through several layers and often reaching entirely across the width or length of the deposit. These sand streaks are due to the filling of channels which were cut in the clay beds after they were elevated to form dry land. Often a deposit of entirely different material may be dumped on top of the clay beds. This in turn may again be overlain by clay, giving rise to a succession of alternating layers of clay, sand, or gravel, and clay. If the clay bed is not much thicker than the sand, the deposit may be rendered worthless.

Another common feature of clay deposits of sedimentary origin is the tilting and folding of the strata after they were laid down. Both tilting and folding have an important influence on the form and extent of the outcropping beds. Where the crests of the folds are worn away by erosion, then the various strata will outcrop on the surface as parallel bands, the width of the outcrop depending upon the degree of dip. If the clay strata are so hardened that they break under the stresses and strains that produce folding, a fault may result. Indeed, faults are by no means uncommon in clay deposits. The gradual erosion of the surface may cut away the clay beds in places, leaving them only on the top of the higher hills or hillocks. This may give rise to a number of conditions that at first may seem somewhat puzzling.

When clays become covered with great thicknesses of other material, or when they are greatly folded, the pressure and heat thus produced may result in their alteration to a shale which is much harder, contains less moisture, is non-plastic, and often brittle. Many of these shales, however, when ground and mixed with water, possess as high a degree of plasticity as did the original clays from which they were derived. This fact is taken advantage of in numerous localities where plants manufacturing clay products are working with hard shales, or mixing shale with clay. In a broader sense, then, when the term clay is used, it includes these deposits of consolidated clayey matter from which the moisture has been squeezed.

Chemical Changes in Clays

Most all the chemical changes produced on clays are the result of weathering or percolating waters acting under superficial conditions. These changes may be grouped under the following heads:—(1) Change of color. (2) Leaching. (3) Softening. (4) Consolidation.

It has already been shown how red, yellow, and brown clays usually owe their color to the presence of compounds of iron. It will be readily understood how a given deposit may gradually change color as the chemical combination of the minerals in the clay becomes altered. All changes in color of clay are not the result of weathering, for often the difference in color between various portions of the same deposit, may be due to original differences in chemical composition.

When surface waters seep into clays they may dissolve out much of the calcium carbonate or other soluble minerals that may be present. This explains why many clays are lean in lime in the upper layers, and richer in lime below. The softening of clay by weathering usually has a beneficial effect, and many manufacturers take advantage of this by spreading the clay out in thin layers in the sun before attempting to work it up. The effect is to disintegrate the clay, render it more plastic, and break up such injurious minerals as pyrite, etc. For this reason the clay near the outcrop of many deposits shows a higher plasticity than that below.

DISTRIBUTION OF CLAYS IN THE UNITED STATES
(Compiled by H. Ries)

Fireclays:
- (1) Carboniferous; Appalachian and Central States.
- (2) Cretaceous; New Jersey and West.
- (3) Tertiary; Pacific Coast, Missouri, Texas and Mississippi.

Pottery clays:
- (1) Kaolin or china clays; older rocks; Georgia, South Carolina, North Carolina, Pennsylvania and Delaware.
- (2) Ball clays (sedimentary); Tertiary; Kentucky, Tennessee and Florida.
- (3) Stoneware clays; (a) Carboniferous; Appalachian and Central States; (b) Tertiary, in the West; Cretaceous also.
- (4) Earthenware clays; found anywhere.

Vitrifiable clay (Sewer-pipe clay):
- (1) Devonian; in Eastern States.
- (2) Carboniferous; in Central States.
- (3) Cretaceous and Tertiary; in the West.

Brick and tile clays:
- Impure surface clays and shales; very wide distribution geologically and geographically.

When clays contain limonite or siderite (carbonate of iron) these sometimes tend to collect around nuclei such as pebbles and grains of sand to form hard ball-like concretions which become scattered through the deposit, especially in the more weathered portions. They often form along well defined zones such as stratification planes. Where these are numerous and widely scattered through the deposit, they do great damage and may render the clay worthless. Where they occur in localized zones it may be possible to throw them out or avoid them in mining.

Prospecting for Clay

Most clays outcrop at the surface so that in searching[2] for deposits of this nature, the prospector has a great advantage. The exceptions to this rule are found in certain deposits of fire clay, especially those associated with coal

seams, where the clays may only be exposed after mining excavations show them up; and in some clay beds, occurring in horizontally bedded strata which have been entirely covered by some younger sedimentary formation. The outcrops are usually found on steep inclined surfaces or in natural or artificial cuts; or along the banks of streams or gullies. If a bed of clay outcrops on a hillside, the clay, acting as an impervious stratum or dam, often diverts the ground water to the surface. Thus, springs occurring at about the same level along a slope often indicate the strike of a clay bed. In glacial drift the presence of ponds often indicates clay beneath. Since clay deposits are often found as the result of the weathering of various rocks, such as granite, sandstone and limestone, the prospector should bear in mind the characteristics of such residual deposits. In general they will be extremely irregular in both horizontal and vertical extent. In some places, clays produce vegetation of a different character from the growth on the other soils, but this cannot be relied upon as a criterion.

The character of the bottom of the clay bed is of great importance in excavation. A rough irregular bottom, with projecting pinnacles of unaltered rock extending up into the clay will preclude steam-shovel work.

All sedimentary clays present a stratified structure. Aside from this, however, different deposits may exhibit extreme irregularity of structure. They may be consolidated into a hard shale; they may have been truncated by erosion and a new material deposited upon this unconformable surface; the deposit may be of varying thickness; there may be pits or chimneys extending down and filling old depressions which will lead to false conclusions; the bed may be folded and faulted; there may be layers or streaks of sand and gravel; or there may be numerous concretions scattered through the mass. All of these possibilities should be investigated before arriving at a definite conclusion regarding the value of the deposit.

Determining the Extent of the Deposit

Assuming that a deposit of clay has been found and proved to be of such a quality as to warrant further testing, what should be the method of procedure? First of all, the shape and extent of the deposit should be determined as accurately as possible. Next, a knowledge of its texture and uniformity must be had, i.e., whether the clay contains sand, gravel, concretions, etc. If these occur in streaks they may be avoided in mining. The character and thickness of the overburden is an important factor to be considered, for it influences largely the method and cost of extraction. If the clay bed is not exposed across its entire thickness, holes should be bored through it at several points and the borings carefully preserved for samples. A posthole auger, cutting a hole 3 or 4 in. in diameter, will be found to be convenient for this purpose up to depths of 30 to 40 ft. The size of the samples to be taken will depend upon the locality and convenience of transportation. When it is possible, 50-lb. samples should be sacked so as to insure plenty of material for a test on a working scale to supplement the laboratory tests. If it is not practicable to get samples of this size, 5 or 10-lb. samples should be taken as a minimum. The samples should be taken from several points on the clay bed and from the bore holes. If larger samples are desired for running large working tests, pits should be dug at the points where the borings were made. Clays are usually wet and sticky and for that reason any ordinary tag or label would be destroyed or the mark obliterated. Experience has shown that the best system of labeling clay samples is to use small tin discs upon which the mark is stenciled.

Testing the Clays

While almost any clay can be used for making common brick, many clays are especially suited to some particular use, depending upon their characteristic properties and also to a large extent upon the situation and prevailing industry of the region. This particular use is the one to which the clay should be put in order to insure the largest profit, so the problem at hand, after the discovery and location of a deposit, is to determine the use for which the material is best adapted. A chemical analysis of a clay is of little practical value, except in a few cases to be mentioned later. The commercial value of most clays will only be disclosed after a careful consideration of their physical properties. The most important tests to make are the following:—(1) water required to attain maximum plasticity; (2) the air shrinkage; (3) fire shrinkage; (4) percentage of absorption after burning at different temperatures; (5) color after burning at different temperatures; (6) fusibility; (7) tensile strength; (8) plasticity; (9) rapid drying test.

A mechanical analysis is often desirable to determine the relative amounts of the different sizes of the constituent grains. If the clay is to be subjected to artificial rapid drying, it should be tested to see whether it will stand it without warping or cracking. A simple chemical test often made is the determination of soluble salts. In clays to be used in the manufacture of portland cement, the percentage of $CaCO_3$ or dolomite, is important. All of the physical tests enumerated above are made in the laboratory on small bricklets about 4x1x¾ in. The question as to how these laboratory results will compare with those obtained in actual practice is one which is commonly raised. In general, if the tests are carefully conducted, the results will be close. The air shrinkage is sometimes higher than in the factory on account of better mixing facilities at the latter place. In very sandy clays the error will be the other way. In practice the kilns are fired slower than in the laboratory and this generally results in brighter colors at the factory for the iron in the clay has a better chance to oxidize.

Mining Methods

Clays and shales are commonly worked as open pits or quarries, but in some instances underground methods are employed. If the deposit lies near the surface and but little overburden must be removed, then open quarries are universally employed. Clays are usually soft and do not require the use of explosives. In small operations where only a limited amount of clay is mined, hand labor with pick and shovel is commonly used, but in more extensive plants, plows and scrapers, or even steam shovels are in use. In some deposits of tough clay or hard shale, blasting is frequently necessary in order to loosen up the material. Clay pits are usually drained by a series of ditches.

If the clay bank is high (over 75 ft.) it is usually carried down in a series of steps or terraces in order to prevent sliding when the clay gets soaked. This slipping or sliding along some seam or contact zone in the clay is a danger constantly present in high banks of wet clay and the factory or structure of any kind should never be placed at the base of such a bank. In several instances entire clay yards have become buried beneath one of these landslides.

Where the clay is not uniform in character, but contains alternate layers of material of variable composition, it is often desirable to excavate these different grades by layers and store them in separate piles. Another method of mining deposits of mixed clays is by a series of small pits dug by hand with a gouge-spade. The material is graded and thrown into separate heaps at the surface. Where the pit is too deep for the workmen to throw the clay to the rim a platform is constructed half way to the surface, and the material is shoveled from the platform to the top of the pit. Buckets and windlasses are also used.

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[2] "Prospecting and Testing of Clay Deposits," E. K. Soper, Min. and Sci. Press, June 4, 1910, p. 827.

[3] J. H. Collins, "The Mining Industry," Vol. XIII, p. 472, 1905.

The method of haulage from the bank to the shipping point or works will depend chiefly on the distance and quantity of material to be hauled, and also upon the topographical conditions. If the works be near at hand the clay is trammed by hand or in barrows from the pit. Mules are often used to haul a train of six or eight cars, or horses and carts may be employed. Where the pit is roughly circular, in plan, and carried down in a series of steps or terraces, horses and carts are convenient and can be placed at the bank and the clay can be broken directly into the carts. In regions of a precipitous character, or where the works are placed at elevations considerably above or below the clay pit, aerial tramways are often employed. Steam haulage is used only in the larger works, and in general is economical only for distances greater than 1000 ft., and where the locomotive is kept more or less constantly employed. Various methods of stripping the clay beds are in use in different localities. Where the overburden is thick and extends over the entire deposit, steam shovels may be profitably employed. Wheel scrapers are often used where the distance to the dump is short. Some large clay beds have been stripped by hydraulic methods.

Kaolin Mining

Since most of the kaolin deposits worked in the United States are long and narrow, a method often adopted consists in sinking a circular pit in the kaolin about 25 ft. in diameter. As the pit proceeds in depth, it is lined with a crib-work of wood. This lining is extended to the full depth of the pit which varies from 50 to 100 ft. When the bottom of the good clay is reached, the filling in of the pit is begun, and the crib-work is removed from the bottom and the timber recovered. Another pit is then started, adjoining the first one. Often several pits are carried down together. In the Cornwall district of England a somewhat unusual method is employed for mining a sandy kaolin at considerable depth. This method is as follows[3]:—

A shaft is sunk in the firm rock of the foot wall of the deposit, which occurs as a steeply dipping kaolin vein. The shaft is continued down to a depth of about 20 fathoms and from the bottom a crosscut is driven to tap the vein. A raise is then put up through the clay and extended to the surface. In this raise a tight wooden launder is placed, and this is provided with lateral openings about two feet apart, each of which is closed by a temporary wooden cover. This is called a "button-hole" launder. The shaft is equipped with suitable pumps and work is ready to begin. The clay ground around the top of the launder is loosened to a depth of 6 or 8 ft. and a strong stream of water played on it. The clay becomes disintegrated and the fine clay particles are washed down the launder, through the crosscut to the sump of the shaft, from where the mixture is pumped to the surface. Here the milky mixture of clay and water is conducted through a series of broad shallow troughs. These are set nearly horizontal, and the stream is divided again and again to lessen the rate of flow and allow the fine sandy and micaceous particles to settle. The refined clay stream is finally conducted to vats where the clay substance is settled out, pressed, dried, and is then ready for use.

A. R. Ledoux describes[4] a similar method recently adopted to work the kaolin deposit at West Cornwall, Conn. This deposit is not a sediment, but is a residual deposit in place. The clay lies in steeply dipping veins, between a foot wall of limonite and a hanging wall of gneiss and schist. The scheme of mining is to disintegrate the kaolin in place by jets of water under pressure, and to float the resultant product to the surface. To accomplish this, holes are drilled through the overlying gneiss, a pipe of 4-in. internal diameter is inserted in the hole and driven in the clay to within a few feet of the foot wall. The wells in operation are from 50 to 198 feet deep. A 2-in. pipe is inserted in the 4-in. one, thus leaving an annular space around the inner pipe for the upward flow of the slip. The clay particles are thus brought to the surface by the same general method that drill cuttings are brought up in churn-drill operations.

Underground Methods

When a clay bed is covered by such a great thickness of overburden as to render openpit excavation out of the question, underground methods may be adopted if the clay is of high enough grade to make the operations, profitable. Such methods, as a rule, are justified only in the case of fireclays or high-grade kaolin. If much water is present, it may render the deposit unworkable. The output from such clay mines is usually restricted, unless the workings underlie a large area and can be worked from several shafts or adits. Underground methods in clay deposits are chiefly developed in Maryland, Indiana, Pennsylvania, Missouri, and a few other states where fireclays associated with coal seams are mined in this manner.

Preparation for the Market

Most clays do not require much preparation before they are ready for the plant. Occasionally they are hand picked to rid them of concretions, pyrite balls, etc. Often the clay is spread out in the sun to dry for a few days before being sent to the mixing pit. In the case of high-grade kaolin and china clay, they are often subjected to a washing process to eliminate any sand, pebbles, and other impurities. The disintegration of the kaolin is usually accomplished in washing-troughs, in which there revolves a shaft, carrying a series of arms or blades which mix the clay thoroughly with water. The water and suspended clay is then discharged into a series of shallow wooden troughs set nearly flat. As the slip passes through these troughs the heavier particles of sand settle out first, and lastly the fine clay substance is settled in large settling tanks.

Methods of Brick Making

There are so many clay products manufactured for various purposes that it will be quite impossible to discuss them even in a general way in a paper of this nature. The commonest clay product, and the most important of all, is brick. The manufacture of brick is such an important industry and one so widely carried on that a brief consideration of the methods in use may not be out of place.

There are three ways of molding brick. These are: (1) Soft-mud process; (2) stiff-mud process; (3) dry-press process. The clay to be molded, if either of the first two methods be used, must first be ground and then mixed with water to a plastic mass. In the dry-press method, the ground clay is pressed dry, without the addition of water.

In the soft-mud process, the bricks are molded in individual molds, either by hand or by a molding machine. Most plants in the United States now use machines which commonly mold six bricks at once. The clay is worked up to the consistency of a soft mud or paste, and pressed into these wooden molds. To prevent the sticky clay from adhering to the molds, sand is added to the sides of the mold before ramming in the clay. Soft-mud bricks therefore usually show five sanded surfaces, which distinguish them from bricks molded by the other processes. The soft-mud process of molding is adapted to a wider range of clays than any other method, for obviously any clay that is plastic may be worked up by adding the proper amount of water.

In the stiff-mud process, the ground clay is mixed with less water than in the former case, and to the consistency of a stiff mass of sufficient plasticity to be molded to shape, and yet retain its shape while still wet. The plastic mass is fed into a long cylindrical drum which tapers to a small end in which there is a rectangular opening or die, the desired size of the bricks. The clay is

[4]Trans., A. I. M. E., p. 379, 1906.

forced toward this small end by a revolving screw, and is finally squeezed through the die from whence it emerges in the form of a long continuous bar of rectangular section. This bar is received on a moving table which carries it past a row of knives or wires operating on a lever which is lowered at proper intervals and cuts the bar of clay into bricks. The capacity of a stiff-mud machine is from 45,000 to 60,000 bricks per 10 hours, as compared with 40,000 by the soft-mud method. The stiff-mud process is not adapted to so wide a range of clays, however, for only clays of medium plasticity are used.

In the dry-press process, the clay is powdered and then pressed into steel molds in a dry, or semi-dry condition. The faces of the molds are of hard steel and are heated by steam to prevent the clay from adhering to them when pressed. They are also provided with air holes to allow the air to escape during pressing, for if the air were imprisoned with the clay, when the pressure is removed the air would expand and split the brick. The dry-press process is used extensively, for the manufacture of front or facing brick, for in one operation a brick is produced with sharp edges and smooth surfaces. If six bricks are molded at a time, the dry-press machines have a capacity equal to that of the soft-mud machines.

Drying

Before bricks from the soft- or stiff-mud processes can be burned, they must be dried to free them from most of their water. This drying is done (1) in open yards; (2) in pallet driers placed indoors or in sheds; or (3) in drying tunnels. The advantage of the latter method is that drying may continue without break throughout the year. Several tunnels or chambers are constructed side by side, and various plants differ only with regard to the method of heating the tunnels. Steam or hot-air pipes are often employed, or parallel flues underneath the tunnel floor may be used. The green bricks, as they come from the molds, are loaded on cars and run slowly through these tunnels. The temperature to which the tunnels are heated seldom exceeds 120° Fahrenheit.

Burning of Bricks

Clay wares are burned in a variety of kilns, but these all operate with either an updraft or downdraft. The simplest and earliest type of kiln with rising draft is known as a "scove" kiln and is still in use at many smaller plants. These kilns are temporary in nature and are generally constructed from the bricks which are to be burned. The bricks are set in large rectangular blocks, 38 to 50 courses high. As the mass is built up a series of parallel arches are left running through the mass from side to side. The entire mass is then surrounded by a wall of brick, which is daubed over with clay to confine the heat within. The fire is built in the arch-like openings underneath the pile.

In downdraft kilns, the heat is conducted by suitable flues to the top of the kiln chamber, and then down through the ware, whence it is carried out to the stock through flues in the bottom. The bricks on the top receive the greatest heat, while in the updraft type the brick on the bottom get the most heat. The advantage is with the downdraft kiln, for should the top bricks become overheated or semi-fused, no damage would result to the main mass beneath. But in the case where the bottom brick become overheated or fused, they will cause the entire mass to sag and perhaps topple over, thus ruining the entire batch.

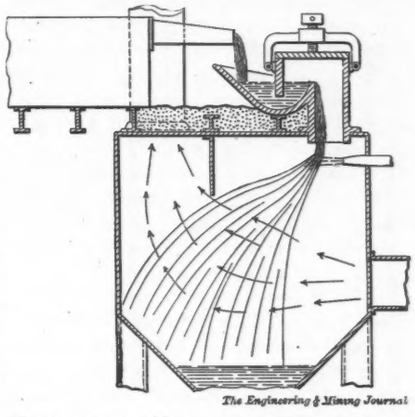
The latest type of kiln, however, and the ones in use in the larger plants, are known as continuous kilns. These were originally designed to utilize the waste heat in burning. They consist essentially of a series of chambers arranged in a line or circle, and connected with each other and also with a central stack by means of flues. Each chamber holds about 22,000 bricks. When the chamber is first fired, the water vapor, smoke, etc., is conducted to the stack for a brief period, but as soon as this ceases, the heat and gases are conducted to the next chamber ahead and forward through several chambers, preheating them before they are actually fired. There is thus a wave of maximum temperature continually passing along the line, ahead of which the kilns are being preheated, and behind which the kilns are being cooled and emptied of their finished ware.

Clay Output of the United States

Owing to the fact that most clay products are manufactured by the producer, and no record is kept of the raw material, the figures for the value and production of clay must be for the manufactured product. In 1907, according to the United States Geological Survey, the total value of brick, tile and pottery manufactured in the United States was $158,942,369. The year 1908 was remarkably dull in the building trades, and the production of clay products showed a great falling-off for that year, the total value being $133,197,762. Of this total figure, brick and tile furnished about 81% of the value. In 1909 the production showed a substantial increase, valued at $166,321,213; in 1910, it amounted to $170,115,974. Accurate figures for 1911 are not available at this time.

Utilization of the Waste Heat in Slag

One of the recent attempts to utilize the waste heat in slag is that of Walter G. Perkins and William H. Barker (U. S. pat. 996,132). This consists in an apparatus by which the molten slag is granulated by a high-pressure air blast while the air for the furnace is then passed through the falling stream of granulated slag. The slag enters the blast chamber in one of two ways, either the slag is injected and atomized at the same time by the air, or else an inverted siphon is



Recovery of Heat from Molten Slag

arranged, the high-pressure blast hitting the slag immediately as it falls from the siphon outflow. The chilled slag is withdrawn from time to time from the blast chamber, which has a hopper bottom, through a water-sealed trap or by other suitable means. The accompanying illustration shows the arrangement of the apparatus with the inverted-siphon trap.

Binder for Copper Chips

A new process for briquetting materials for smelting was recently patented by Max Glass of Vienna, Austria-Hungary. The application is more particularly in the smelting of copper-bearing material that is rather rich in metal, such as grindings and chips.

The material is first treated with ammonium-chloride solution so that all portions are covered. A 5% solution is employed and 1000 parts of the material are mixed with 10 parts of the solution. The mass, states the *Brass World*, is then mixed with quicklime and heated to about 212° F. slowly after pressing in the briquetting press in the usual manner.

The theory of the process, the inventor says, is that cupric oxide is formed on the surface of the metal which, with the lime acts as a binder. The calcium chloride, with the excess of lime, also forms an efficient binder.

Diamonds in the Belgian Congo

By Sydney H. Ball*

An American company recently found over 270 diamonds along the Kasai River in the southwestern part of the Belgian Congo. Another company is prospecting in the southeastern part of the colony on the Kundelungu Plateau and along the Lualaba River, on a tributary of which diamonds were first discovered in this part of West Africa.

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The Belgian Congo, more familiarly known to most of us by its former name, the Congo Free State, has been recently added to the list of countries in which diamonds have been found. Detailed prospecting of the world is showing the diamond, like gold, to be widely distributed, if not in paying quantities, at least as a mineralogic curiosity. In 1906 prospectors of the Tanganyika Concessions Co. found a small diamond in the gravels of Mutendele River, a tributary of the Lualaba (Congo), flowing from west to east. Later other stones (three in 1907, 11 in 1908, and 5 in 1909) were found in the gravels of the Lualaba River not far from the original discovery. The known diamondiferous region includes the bed of the Lualaba and the lower reaches of its tributaries from 9° 30′ to 10° 30′ South Latitude, a distance of 82 miles roughly. The largest stone found to date is reported to have weighed 0.28 carat.

H. Buttgenbach[1] reports that the form of but few of these stones is determinable crystallographically, but that among the perfect crystals the octahedron and dodecahedron predominate. Twins are common, and the crystal faces are frequently curved. About one-half the stones are colorless, several others yellow, and brown, rose, and opaque stones are mentioned.

Prospecting the Lualaba River and Kundelungu Plateau

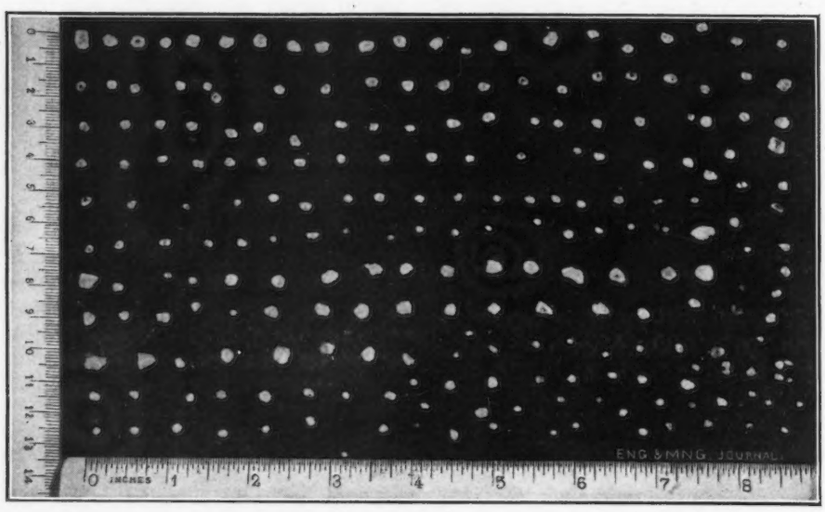
A rock similar petrographically to kimberlite, the basic igneous rock in which the diamonds occur at Kimberley, South Africa, has been found in the Kundelungu Plateau south and southwest of Lake Moero. This rock is reported to occur in about eight pipes, cutting red sandstone of Permo-carboniferous age. At the surface this appears as "yellow ground," turning in depth to a green color resembling typical "blue ground." The concentrates obtained by washing include garnet, diopside, diallage, biotite, phlogopite, olivine, zircon, wollastonite, aragonite, calcite and goyazite. The assemblage of minerals is quite similar to that which accompanies diamonds in the South African pipes. A company (the Kundelungu-Lualaba Co.) has been formed to prospect these two areas, and machinery to wash the ground on a considerable scale has been installed. The stock of this company, which has the exclusive right to prospect for diamonds over an area covering about 2400 square miles along the Lualaba River, and 8160 square miles on the Kundelungu Plateau, is owned by the Katanga Special Committee and the Tanganyika Concessions Co. To date it is believed that no diamonds have been found in association with the pipes, although in the summer of 1910 this company obtained about 12 diamonds presumably from the gravels of the Lualaba River.

[1]"Description des Mineraux du Congo Belge," Annales du Musée du Congo Belge, Bruxelles, 1910, p. 5-10.

Diamonds along the Kasai River

In 1906 American capitalists, prominent among whom is Thomas F. Ryan, joined with a group of Belgian capitalists under the name of the Société Internationale Forestière et Minière du Congo, and took over as a mining concession about 370,000 square miles in the Belgian Congo. In the following summer while searching for gold at Mai Munene in the Kasai River, one of this company's prospectors found a small, although beautifully clear, diamond among his concentrates. Work here was recommenced last summer, and at the mouth of Kabambaie Creek, about 55 miles northwest of Mai Munene, 240 stones were found in two weeks by one man. Since then about 10 stones have been found on the Kasai to the north of the Kabambaie Creek mouth, and several in another region. So far, for about 75 miles along the Kasai River, diamonds have been found either in the main stream or in the lower courses of its tributaries. Prospecting is naturally being continued and further reports are awaited with interest.

The stones occur in riffles or pot-holes in the river bed or in sands along their banks. That they are locally abundant is shown by the recovery of 15 diamonds from about one-fifth ton of gravel. Some of the gravel is cemented by limonite, thus resembling the *cascalho* in which the Brazilian stones occur in places. The cementation is, however, not sufficient to interfere materially with recovery. These stones are in greater part at least well crystallized, the largest weighing about 1 carat. Octahedrons predominate, though dodecahedrons are unusually common, and trisoctahedrons occur. Determination of the more complex forms have not as yet been made. The octahedral faces are frequently curved or show triangular etchings, usually elevations. Interpenetration twins with the octahedral face, the twinning plane, are common and others occur after the Spinel law. An unusual percentage of the diamonds are water white, while the rest are in part yellow and off-color stones, and in part deep yellows, topaz and apple-green stones fit for fancy gems. Among the minerals associated with the diamonds are gold, quartz, cyanite, magnetite, zircon, ilmenite, feldspar, mica, garnet, epidote, rutile and hematite,

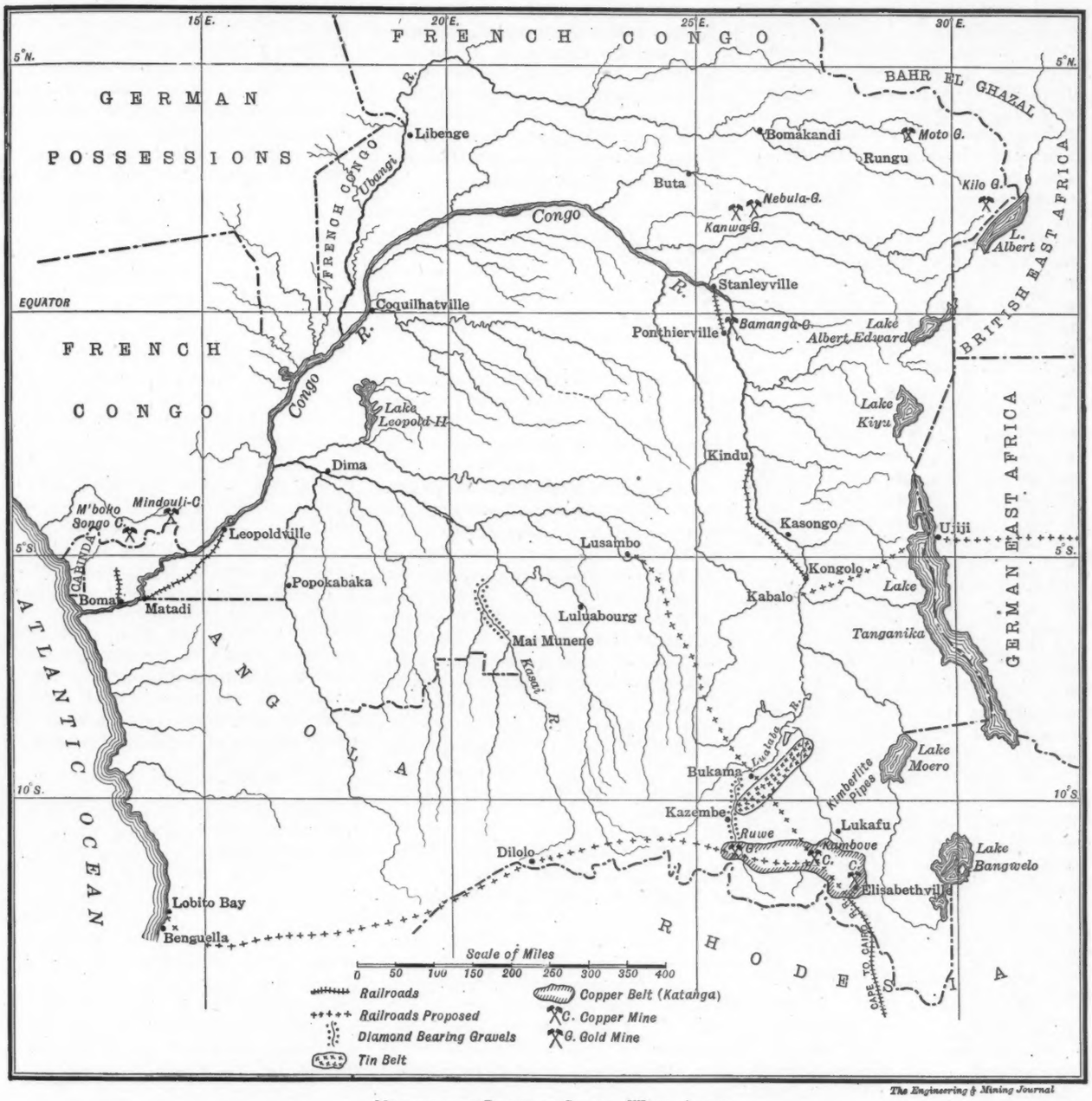


Diamonds Found on the Kasai River—Approximately One-half Size

in addition to carnelian, chalcedony, agate, jasper, chert, diorite, schist and granite pebbles; in short, such minerals and rocks as form the complex of the country upstream. The region is a comparatively healthy one and the more northerly of the finds is but 15 miles from the head of navigation on the lower Kasai on which stern-wheelers ply.

ferous and is presumably as its general appearance indicates, of Pre-cambrian age. In what was presumably Paleozoic time these rocks were planed down to an almost level surface from which, however, a few low ridges protruded. Later, in Jura-triassic time, the Congo basin became an inland lake or possibly a brackish gulf in which a considerable thickness (at least 1500 ft. locally) of sandstones and shales were deposited. These rocks were then lifted above the sea and although they dip slightly to the north, are still approximately flat-lying. They completely cover the central basin of the Congo River, but toward its rim the deeper streams in places have cut down through this rock blanket into the older rocks. At such places rapids occur and the valleys become narrow.

It is in such a stretch of the Kasai River that the diamonds have been found. The diamonds may possibly have originated from one of the old Pre-cambrian-like series, or they may have once formed pebbles in the flat-lying sandstones. It is believed more probable, however, that they will be found in basic intrusive masses which cut the Jura-triassic sandstone. It is of interest to note in this connection that these beds are the stratigraphic equivalent of the Stormberg beds of South Africa, which are the youngest sedimentary rocks cut by the Kimberley diamond-bearing plugs.



MAP OF THE BELGIAN CONGO, WEST AFRICA

JURA-TRIASSIC SANDSTONES CUT BY BASIC PRE-CAMBRIAN INTRUSIONS

This general region consists of a basement series of folded and faulted micaceous schists, quartzite and granitic and basic igneous gneisses, intruded by granites, diabases and gabbros. The series is certainly older than the Permo-carboni-

Recent Developments in Explosives

By A. E. Anderson*

First black-powder factory built in the United States in 1802. A great variety of high explosives has been developed, fitting every requirement of mining. The most recent development is the manufacture of Red Cross powders, from nitroglycerin, nitrotoluene and with or without nitrate of ammonia.

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Note—A paper read at Telluride Colo., Dec. 8, 1911, under the auspices of the Colorado School of Mines and the Colorado Scientific Society, as one of a series of "Practical Talks" on mining and metallurgy.

In 1802 the first powder factory in the United States was built along the banks of the historic Brandywine River in Delaware, Md. The explosive manufactured here was the old black blasting and sporting powder, and it was made in wheel mills consisting of huge stone wheels revolving in a circular wooden track. These mills resembled the chilean mills used by the Mexicans, and were driven by water power, the machinery being all constructed of wood. The buildings were made of stone walls 4 ft. in thickness on three sides, the side facing the river and the top being constructed of light lumber. Every time a chip broke off the stone wheel or any metallic substance was dropped in the track, an explosion resulted which threw the men into the river and blew off the board sides and the top of the mill. After the men had picked themselves out of the river, if they were able, they returned, reboarded the building and started in again making powder.

These old mills with their wooden machinery can still be seen in position, and between them are situated the modern uptodate buildings and machinery which are now used in the manufacture of explosives. In those days these explosions were considered a matter of mystery that could not be explained. However, a close study of the conditions and circumstances has enabled the manufacturers to determine the exact causes; as a result, the wheels are now built with rubber tires and run in a rubber track. Other improvements of course, have also been made so that while the old water power is used and the same process of manufacturing is practiced, an explosion in these mills is extremely rare. The same close study of the characteristics and features of the materials used in the manufacture of explosives has been continued so that from the one explosive then known, common black blasting powder, a large number of explosives of various kinds have been developed, fitting every possible condition and requirement in mining, warfare, hunting and even farming.

Development of New Explosives

In experimental and research work in explosives, the greatest precaution must be observed. The chemists must be thoroughly conversant with all the characteristics and qualities of the materials with which they make their experiments, and also with the compounds and combinations which they make. The least carelessness or lack of knowledge may cause permanent injury to the experimenter. When he develops new explosives he must catch the features as to the strength, quickness or velocity of detonation, quantity and quality of gases produced which make up the fumes or smoke, the ability of the product to withstand water and cold, also its density and stability, and in recent years the size and duration of the flame, and the amount of heat evolved in detonation. After many months of experimental work when he has finally devised some combination of chemicals which forms an explosive which has the proper qualities, the product must be turned over to experts in the field who test it out under actual working conditions to determine the results it produces and the impression it makes on those who are to use it. This makes the process of developing explosives a long, tedious task, which requires the utmost care and knowledge of the subject.

Common Impressions of Explosives

The common idea of explosives is that they are mysterious forces, wrapped up in packages of small size, which are liable to cause most tremendous and disastrous results for no apparent reason and at times when they are least expected to explode. This, however, is entirely erroneous. The du Pont company alone manufactures about 150,000,000 lb. of high explosives per year, at several different factories, and these are transported all over the United States and even to foreign countries, in all kinds of vehicles and under all possible conditions; yet the accidents resulting are extremely rare and the amount of explosives involved in these accidents is an extremely small percentage of the amount handled. When it is considered that a large part of this is handled by unskilled labor, by foreigners who have been in this country but a few months, or a few years, it is remarkable that the percentage of accidents is so small. Many of these men have never had any previous experience in mining, yet underground and on surface they handle explosives without any knowledge of their qualities or how they should be handled. Whenever an accident happens, it is because of some good and sufficient reason, that is, there is always a cause. The idea of mystery that is attached to these accidental explosions is due to the fact that the evidence of the cause is usually destroyed, and the persons involved are usually killed or rendered unfit to give careful testimony as to the reasons for the accident.

Classes of Explosives

Explosives in general are divided into three classes, namely, propelling, bursting and blasting. Propelling explosives are those which, when exploded exert a pressure that propels a projectile a greater or less distance from shotguns, rifles, revolvers, mortars or cannons. Of the bursting explosives, which act quicker and are used principally for exploding projectiles in warfare, we will not deal at this time. Under the blasting explosives, with which we will deal principally, there are two general classes: (1) high explosives, which are quick acting, and (2) low explosives which are slower acting. The high explosives, otherwise known as the detonating explosives, are extremely quick in their action and are composed of definite chemical compounds which are broken up by the use of a powerful detonator.

Fulminates and Nitroglycerine

Generally classed with these high explosives are the fulminates, which are used in detonating the other high explosives. They differ from the others in the fact that full explosive force is generated by simple ignition. Fulminates can be made of most of the metals, even of gold, silver and platinum, but they are so extremely sensitive to the slightest shock, heat or friction, that they cannot be used in ordinary work. The fulminate of mercury, however, has the necessary characteristics to render it valuable as a detonating agent.

Nitroglycerine, which is made by treating glycerine with nitric acid in the presence of sulphuric acid, forms the main basis of the high explosives which are in practical use at present. Nitroglycerine freezes at a temperature of from 45 to 50° F., and its sensitiveness to shock, heat and friction varies directly as the temperature, so that it is necessary to have it at a temperature of from

55 to 75° in order to produce the maximum results and still have it in a condition safe to handle. As nitroglycerine in a liquid state is dangerous as well as inconvenient to handle, the first development in the manufacture of high explosives was to absorb the liquid nitroglycerine in a porous material, the first of which was infusorial earth. This, however, has been replaced by wood pulp as an absorbent, and to this are added active chemicals, which are not only consumed in the explosion but also aid in the sudden production of gases and greater heat, the latter giving these gases the greatest possible explosive force.

Gun Cotton or Gelatin Explosives

The next step was the use of guncotton in combination with nitroglycerine. Alfred Nobel discovered that about one part of guncotton dissolved in nitroglycerine, produced a jelly-like mass which had a greater explosive force than either or both of them uncombined. This material is used as a base of the blasting gelations and gelatin dynamites which are largely used in western mining at present. They have many advantages over the old-fashioned straight dynamite, in that they are practically waterproof, more dense and plastic, and are safer to handle, as they have little tendency to leak or exude nitroglycerine. Between the nitroglycerine dynamites and gelatins, we have recently developed the semi-gelatins, whose features and qualities are practically between those of the other two.

Nitrate of Ammonia

Later it was discovered that nitrate of ammonia, a compound which in itself is not explosive, could be combined with nitroglycerine to produce an explosive which is also safer to handle, less sensitive to shock and friction, and has a slower and more rending effect than the straight nitroglycerine dynamites. The nitrate of ammonia is a crystalline compound which is extremely insensitive to shock, friction or heat, and has a great affinity for moisture. These explosives are therefore not as good to use in wet work as either the dynamite or gelatin, but they evolve less noxious fumes than the dynamite, and for certain classes of work are superior to either of the others.

The most recent development has been the introduction of nitrotoluene, which has the property of reducing the freezing point of nitroglycerine. This is also an explosive compound when mixed with nitroglycerine, and explosives made of this mixture do not freeze above a temperature of 32° F.,—that is they will not freeze until water freezes and will thaw when ice melts. The explosives made of this combination of nitroglycerine, nitrotoluene, and with or without guncotton or nitrate of ammonia, are called Red Cross low-freezing powders. They are of especial advantage for use in work that is wet, and where there is a variation of from 35 to 50° F. in the temperature of the water.

Permissible Explosives

Following the actions of foreign governments in investigating explosives manufactured and used, the U. S. Government formed a technologic branch of the Geological Survey, for investigating causes and remedies for accidents in mining. This work has recently been transferred to the Bureau of Mines. A large part of the work done by this bureau has been a thorough investigation of the explosives used in the United States, with the special object of determining what explosives are safest for use in coal mining. These explosives are listed by the Government as permissible explosives. The requirements which these explosives must fulfill are, that they can be used under certain conditions in the most explosive mixture of gas and dust without causing the mixture to explode. The special features to be noted are the size and duration of the flame and the amount of heat evolved in detonation. It requires about one second to ignite mine gas at a temperature of 1000° F. If the amount of heat is less the time required for ignition is longer. If the heat is greater the ignition will be obtained in a shorter time. With the dynamite the heat produced is about 1500 cal. per kg. and the duration of the flame is a fraction of a second. In exploding a stick of dynamite in the dark and photographing it, the size of the flame produced is small but intense, making a charge limit of 4 grams. With black blasting powder, commonly used in coal mines heretofore, a temperature of about 600 cal. per kg. was produced, but the size of the flame was large and lasted sometimes almost a minute, making a charge limit of 5 grams. In these permissible explosives the temperature produced is not over 600 cal. per kg., the duration of the flame is about 1/25 of a second, and the visual flame produced is extremely small, so they have a charge limit of 500 to 1000 grams.

The explosives which have passed this test in the United States so far are of two kinds. First, the low-flame, nitroglycerine explosives, which are simply dynamites in which chemicals have been added to reduce the heat and quench the flame, and make the action of the powder slower. The second class, and the one which is in more general use, comprises the nitrate-of-ammonia explosives. These are made largely of nitrate of ammonia with the introduction of some other explosive compound as a sensitizer to render the nitrate of ammonia explosive. These permissible explosives are rapidly superseding both black blasting powder and dynamite, in the mining of coal. One of the great features of these nitrate-of-ammonia explosives is that the nitrate of ammonia is not affected by the lower temperatures, so that they can be used without being thawed. Another feature is that nitrate of ammonia is extremely hard to ignite and therefore a burning hole is unheard of with this explosive. On account of its safety in handling, nonburning and nonthawing properties, this explosive has also come into extensive use in outside work of all kinds in dry material, such as quarrying and open-pit mining.

Low Explosives

These are explosives in which the explosive force is generated by the simple ignition and burning of the charge. They have been made in practically the same way for over 100 years. They consist of 75% of potash or sodium nitrate, 15% carbon in the form of charcoal, and 10% of sulphur. The potash powders, known as the A blasting powders, are little used in mining work and they are more expensive than the soda powders. The black sporting powders and ammunition come under this class. The B blasting powder, made of sodium nitrate or Chile saltpetre, is a common black blasting powder used in mining work. This powder is made in different sized grains which regulate the speed of burning. The nitrate of sodium being easily affected by moisture the grains are protected by a glaze or covering of graphite.

Until recently this powder was always exploded by means of a fuse or squib. The fuse is the same as used in metal mining and consists of a core of fine powder wrapped in and surrounded by hemp cords and waterproofing material. The squib is merely a pencil of powder wrapped in a piece of paper so that when the paper is ignited it sets fire to the powder, and they are so constructed that the explosion of this powder shoots the squib for a distance of several feet into the charge of the blasting powder. Recently, however, we have been able to manufacture an electric squib, consisting of a small capsule of powder which is ignited by means of an electrical current passing through a small platinum bridge.

A few years ago an explosive was manufactured in which the burning effect of the black blasting powder was augmented by the addition of a small percentage of nitroglycerine. This is called Judson powder, and is exploded by means of a primer consisting of a ½-lb. stick of 40% dynamite for each 10 lbs. of the Judson powder.

Packing, Storage and Handling

Due to the accidents that have occurred in the use of explosives, the packing, transportation, storage and hand-

ling of explosives is regulated to a large degree by a branch of the Interstate Commerce Commission, called the Bureau for the Safe Transportation of Explosives. This Bureau has formulated rules and regulations which regulate the exact way in which the explosives must be packed, to the minutest detail, even to the number of nails used in fastening the covers. Explosives must be transported in cars of a certain kind and in perfect condition. They must be stored in buildings which are remote from dwellings or highways, and must be fireproof, bulletproof, and well ventilated. So well are these things regulated that the number of accidents have been extremely few. In the handling of explosives after they leave the hands of the transportation agent or the dealer, regulations are less severe, and the conditions are so varied that it is almost impossible to make up a set of rules and regulations governing this feature. The fact of the matter is that the explosives now manufactured and in general use are safe enough to stand any reasonable handling.

Thawing

The main source of danger is that of thawing the explosives when they have become frozen, to render them in proper condition to produce maximum results. Most of the accidents with explosives have occurred while they were being thawed. Every box of dynamite contains a pamphlet of instructions which tells the proper and safe ways of handling and thawing them, and they should be followed out to the letter. Explosives should never be subjected to direct dry heat. That is, they should not be thawed on heated stoves, rocks, sand, brick, or metal, or in an oven, or in front of or near or over a steam boiler or fire of any kind.

Preparing Primers

In the use of explosives one of the most important features is the proper detonation of each individual charge. This is obtained by using the correct detonator and by the proper preparation of the primer. In preparing a primer, the fuse and cap should be inserted into the cartridge in one of two ways. Either a hole should be made in the end of the cartridge large enough and long enough to put the whole cap into the powder, and the paper on the end of the cartridge should be tied securely with a string around the fuse, or the other way is to punch a slanting hole into the side of the cartridge of the same size as the cap and fasten the fuse securely by tieing a string around the cartridge. The fuse should not be laced through the powder, as there is a possibility of the fire spitting out of the fuse and igniting the explosives. A sharp kink should not be made in the fuse, as it is liable to break the train of powder and cause the fuse to stop burning at that point, especially if water is present.

Position of Primer

With the explosives in use in Colorado namely, the gelatin dynamites, there is no doubt but that the proper position for the primer is near the bottom of the hole, and the best results will be obtained by pointing the closed end of the cap toward the center of the charge. There are two reasons for this; (1) because if the primer is near the bottom of the hole there is less liability of one hole cutting off the fuse in an adjacent hole ahead of the burning powder and (2) because the explosion of the powder starts at the detonator and the force is greatest at that point; the bottom of the hole being the strongest, it is the part that requires the greatest explosive force. For instance, if a primer stick is laid on the ground with two or three sticks touching it end to end, it will be found after exploding, that the primer stick has made the largest hole in the ground. If this test is carried out further, and a long string of powder is laid along the ground with a detonator at one end, you will find by actual measurements that the hole produced in the ground by each succeeding cartridge will be slightly smaller than the one before. The less sensitive the powder, the more marked this difference will be. Therefore it is proven that caps should be inserted in the powder at about every 5 ft. along the charge in order to regenerate the explosive wave.

Strength of Caps

A few years ago the common cap in use in Colorado and other districts was the 3X blasting cap. This contained 8.3 grains of fulminate of mercury. At present the cap in general use is the No. 6, containing 15.4 grains of fulminate, which is practically twice the strength of the former, and the tendency is still toward the larger cap. One of the reasons for this is that the explosives used now are less sensitive, safer to handle, and are also of a different nature than those used originally. Gelatin powders, composed of a jelly-like mass, have a tendency to retard the explosive wave which carries the detonation through the powder. It takes therefore a greater initial force to carry that wave at the same speed and with the same force through a substance which tends to retard the wave, than through the old nitroglycerine dynamites.

The resultant gases under complete detonation are mainly carbon dioxide and nitrogen, with a little excess oxygen. These are all harmless gases and the excess of oxygen prevents the formation of carbon monoxide gas, which is poisonous. The best way to insure complete detonation is to use a strong cap. If the detonation is incomplete, we have a deficiency of oxygen, and carbon monoxide is likely to be formed. It is also true in cases of incomplete detonation that nitroglycerine is sometimes volatilized, which also has an injurious effect.

Quickness of Gelatin

The gelatin dynamites or blasting gelatin differ from all other explosives, in the fact that the quickness does not increase with the strength. That is, 35% gelatin has the same quickness as 80% gelatin. It has been found that the only way to quicken gelatin powder is to us a stronger detonator. For instance, gelatin dynamite detonated with a No. 6 cap is much slower than nitroglycerine dynamite detonated with the same size cap. However, if a primer composed of one stick of nitroglycerine dynamite is used to explode the gelatin, it makes the gelatin even quicker than the straight nitroglycerine dynamite of the same grade. However, as it is inconvenient to use two kinds of explosives in the same hole, the added quickness can be better obtained by using a stronger detonator. It has been my experience that rock which could not be broken with 40% gelatin dynamite using a No. 6 cap, could be broken in excellent shape with the same charge of powder by using a No. 8 cap, which is almost twice as strong as a No. 6, and contains 30 grains of fulminate of mercury.

Electric Detonators

One of the recent developments in the use of explosives has been the manufacture of electric detonators. These are the same as the ordinary blasting cap, except that on top of the pressed charge of fulminate of mercury is a loose charge, imbedded in which are the ends of the two wires of the fuze, connected by a platinum-wire bridge. The passing of an electric current of 1½ volts and 1½ amp. through the bridge will raise it to a temperature sufficiently high to ignite the loose charge of fulminate and to set off the exploder. The most recent invention along this line has been the delay-action exploders, in which a piece of fuse of a certain length is inserted between this loose ignition charge and the pressed charge, delaying the explosion of the fuze for about two seconds in the first-period delay fuzes, and four seconds in the second-period delay fuzes. By using the no delay, first-period delay, and second-period delay fuzes, the shots can be fired in three distinct rounds, the idea being that while the rock

from the first round is in the air the second round will explode and while this is in the air the third round will explode, thereby avoiding the necessity of relifting the material already blasted. In actual practice it has developed that a round of holes can be blasted in this way with considerably less powder than either with fuse and cap or with all instantaneous exploders. This system of firing is especially advantageous in shaft-sinking and rapid tunnel-driving. In order to make electric blasting surer and safer, we have recently devised an instrument for measuring directly in ohms the resistance of a blasting circuit without exploding any of the fuzes. This Dupont galvanometer is composed of a delicate chloride-of-silver cell which produces just sufficient current to deflect the needle of the galvanometer, and not enough current to heat the platinum bridge in the exploders. With this it can be determined if there is a circuit through all the exploders and if not, the break in the circuit can be easily detected.

Blasting Machines

Electric exploders can either be exploded by means of a current from any electric circuit of over the required voltage, or by means of blasting machines of various capacities, which are made for the purpose. We have recently devised an instrument for testing the capacity of these blasting machines, without using a large number of fuzes. This is a delicate rheostat which has known resistance; thus, a resistance equivalent to a certain number of exploders is put in series with one exploder, and if the machine will explode this one through this resistance, it will explode the full number of exploders having that resistance.

Handling of Explosives in Mining

In the early days of mining the miners were composed largely of Americans or North Europeans, who were intelligent men and knew how to handle explosives better, in most instances, than even the officials of the mining companies. In later years the use of the new explosives and the necessary introduction of less intelligent labor has necessitated the more careful supervision of the use of explosives. In the larger mines some detailed and efficient systems have been devised for handling, distributing and keeping track of the amount of explosives used in each part of the mine, and by each set of men.

In the coal mines the adoption of permissible explosives has developed several different forms of shot-firing systems where the drilling, loading and firing of the holes is being done directly under the supervision of skilled shot-firers. Electric detonation is usually used, and in some cases the shots are all fired at once from outside the mine and no one is in the mine at the time. In some of the larger metal mines, where a great number of men are employed, the man in charge of blasting in each place usually writes an order for the exact amount of explosives he needs and the number of primers. This order is prepared, filled, and sent in to him and the order is kept on file so that a record can be made of the quantity of explosives that each man uses, the results he obtains and the cost thereof. The mere fact that a record is kept of this, and the work of different men is compared, induces the men to use careful judgment in the amount of explosives used and the results obtained. The preparation of the primers by a man whose duty it is to prepare them properly and have them kept in good condition, reduces the number of misfires.

Calculation of Charges

There is no exact method of calculating the charge of explosives in any particular kind of ground, but the amount used must be judged by the experience of the miner and the results obtained under similar conditions. However, there is a way of calculating the charge after one trial has been made. For instance, if a round of holes has been loaded with 100 lb. of 40% gelatin and has only pulled 4 ft. in a 5-ft. round, the following system could be used in calculating the proper charge:

The units of strength in a certain weight of explosives can be calculated by multiplying the weight by the rated strength, so that 100 lb. times 40½ strength gives 4000 units in strength. If the 4000 units has only pulled four-fifths of the round, it will require 5000 units to break bottom. However, results could be more economically obtained by substituting a higher grade in place of part of the 40%, so that if 50 lb. of 40% are used, which would be 2000 units of strength, this would still leave 3000 units to be supplied by, for instance, 80% gelatin, to be placed in the bottom of the holes. Three thousand units divided by 80% gives 37½ lb. of 80% gelatin. The cost of the 80% gelatin in the bottom of the holes plus the cost of the 50 lb. of 40% on top of that, would be no greater than for the 100 lb. of 40%, and would pull at least 1 ft. more of ground. This method of calculation can be used whenever one explosive is substituted for another. Eighty per cent. gelatin dynamite and blasting gelatin are never loaded alone in a round of holes, but are loaded in the bottom and some lower grade used on top. This system produces a maximum of economy and is still safe if the primers are placed in the higher grade explosive.

Fast Tunnel-Driving

Recently rapid strides have been made in the driving of tunnels through hard rock. This fast progress has been accomplished in several ways: (1) by drilling deep rounds of holes; (2) by using powerful explosives, which enabled the breaking of deeper ground, and (3) by doing the work in a systematic manner. A noteworthy case of this recently, has been the breaking of the record for fast tunnel-driving in the United States, which was made in the Laramie-Poudre irrigation tunnel by J. A. McIlwee, contractor. In this tunnel, 7 x 9 ft. in size, the holes were drilled from 10 to 12 ft. in depth, using two short cut holes in the center and giving the cut holes all the lift that was possible both in a horizontal and vertical direction. By using blasting gelatin 100% strength in the bottom of the holes and 50% gelatin on top of that, with the primer in the blasting gelatin, it was possible to pull 10 ft. clean per round in the toughest kind of blue, close-grained granite. Two of these rounds per day were put in so that in one month 653 ft. were made, or over 20 ft. per day.

Tamping Explosives

With the gelatin explosives, the more closely they are packed in the hole the less air space there is in the charge and the greater the force developed. It is also true that if the explosive is confined by means of tamping, a greater force is produced. In holes which point downward water tamping can be used to the best advantage. In upper holes the best material is damp clay placed in special tamping bags, which are made for this purpose.

In the San Juan region, Colorado, no attempt has been made to introduce new explosives since the gelatin powders replaced the nitroglycerine dynamites. The reason for this has been that no explosive has been developed that is superior to the gelatin for the conditions in that district. However, the use of No 6 caps has been urged and put in practice in place of the smaller sizes.

British Cement Combination

A new amalgamation of British cement works to have an issued capital of $17,032,000 is proposed. This is to be known as the British Portland Cement Manufacturers (Ltd.), says *Daily Consular and Trade Reports*, and the annual capacity will be about 1,500,000 long tons of cement. In addition there will be a working agreement with the Associated Cement Co. It is claimed that the two will control five-sixths of the British cement output, and their combined capital will be about $58,398,000. There will be no public issue of stocks or shares.

Power System Cleveland Cliffs Iron Co.

By C. A. Tupper*

The Carp River is being harnessed to provide power for Michigan iron mines. The system when completed will consist of one large hydro-electric plant supplemented by two steam plants, each distributing current at 60,000 volts over an area of 40 square miles.

*Consulting engineer, 389 Thirty-first Ave., Milwaukee, Wis.

Note—Reprinted from Power, Jan. 9, 1912.

The Cleveland Cliffs Iron Co. is constructing a hydro-electric power system which will serve all of its mines on the Marquette range, a district in which this corporation is the largest operator. The Carp River is being harnessed and about 6000 kw. will eventually be developed. The project is the second of its kind upon which this company has embarked, the first having been on the Au Train River, and is one of the most important undertaken in upper Michigan. Much important preparatory work has been done with the installation of a large quantity of electrical machinery at the mines and shops, including motor-driven trams, hoists, pumps, compressors, tools, etc., the construction of transmission lines, and the establishment of two large central generating stations, equipped with steam turbines, which now furnish the power required and will later serve as auxiliaries to the hydro-electric plants.

Concrete Dam

The site chosen for the water-power station is a mile from the point at which the Carp River empties into Lake Superior, at the foot of Mt. Mesnard. The concrete dam now under construction is about four miles from the generating plant. Its spillway is 120 ft. long and 48 ft. high, and secure protection against washouts has been provided by a curved retaining wall 150 ft. long and 7 ft. wide, reënforced horizontally with old cables at the point where it joins the main spillway.

The water will be carried to the wheels in a steel and stave pipe line 21,500 ft. in length, and 60 to 66 in. in diameter; 8567 ft. being of lock-bar steel, 2233 ft. of welded steel and the remainder of wooden staves. A surge tank 16 ft. in diameter and 130 ft. high will be placed at the top of Mt. Mesnard; the available head is about 600 ft. At the power plant two 3000-kw. Allis-Chalmers hydraulic turbine units and three 1900-kilovolt-ampere transformers are being installed. The system is designed to carry 60,000 volts, but, for the present, current, will be transmitted at 30,000 volts. It is expected to have the new plant in operation early next spring.

Transmission Line

The transmission line under construction, which consists of No. 2 B. & S. solid-copper cable carried on steel towers, will connect the Mt. Mesnard power house with the auxiliary and distributing station already in service at the Maas mine, Negaunee, which is in turn connected similarly with a plant of the same kind at the Princeton mine in the Swanzy district and with the Cleveland Cliffs properties in the Ishpeming and North Lake fields. Altogether the transmission system covers a territory of 40 square miles, and there will be a double circuit over the entire line.

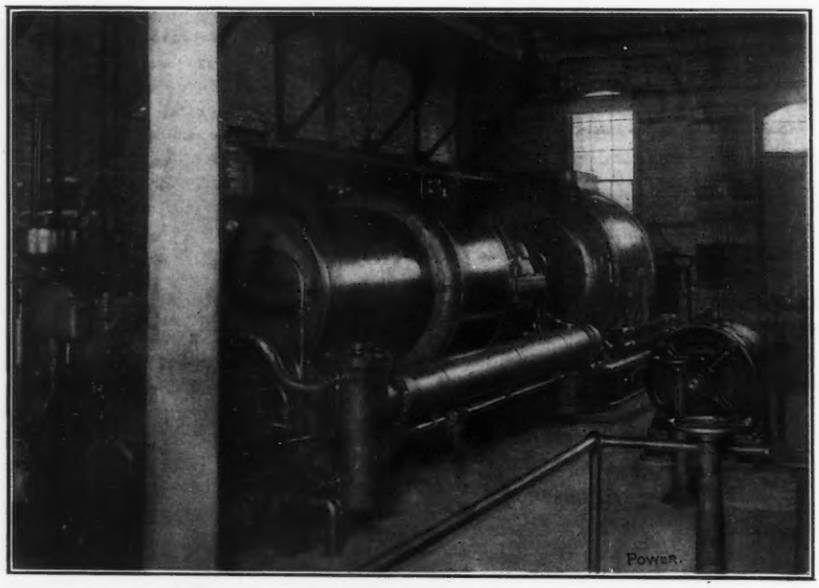

Fig. 2. 1500-kw. Turbine at Maas Mine Plant

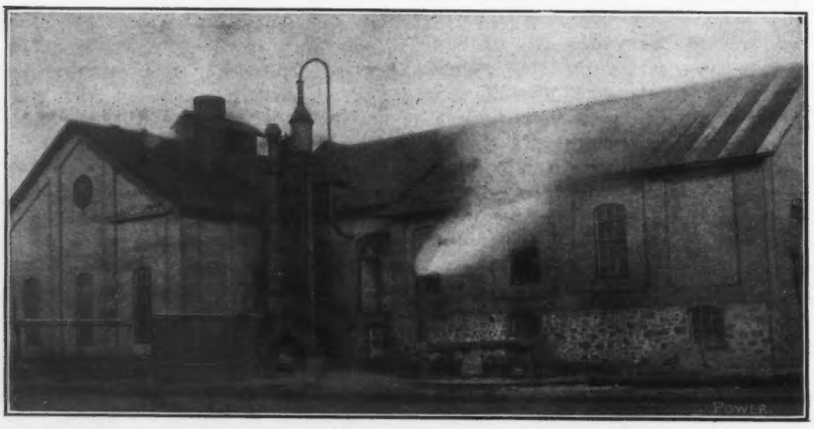

Fig. 1. Exterior View of Maas Mine Plant, Showing Condenser

Steam-turbine Plant

The steam-turbine plant at the Maas mine (see Fig. 1) is laid out in accordance with good engineering practice. The boiler room contains four 350-hp. Stirling boilers, with Murphy stokers, the furnace fronts being set out 7 ft. from the boiler fronts. This gives room for bins directly over the furnaces, which are supplied with slack coal by cars which run over the top of the bins and which are raised by a steam-hydraulic elevator. Induced draft is provided by a Sturtevant engine-driven fan, delivering the products of combustion to a 25-ft. steel stack set inside the building on a concrete foundation.

Engine Room

In the engine room all the auxiliaries, except the exciter and switchboard, are placed beneath the concrete floor. The electric-generating apparatus consists of a 1500-kw. Allis-Chalmers steam-turbine

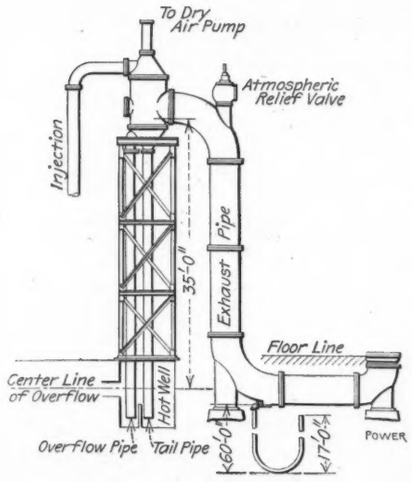

Fig. 3. Condenser with Automatic Drain Trap

set, which delivers three-phase, 60-cycle current at a terminal pressure of 2300 volts. The turbine receives steam at about 150 lb. pressure and exhausts at about 28 in. vacuum to an Allis-Chalmers condenser, of the barometric type, which consists of a 42-in. head provided with an air cooler, water distributor, spray plates and equalizing pipes. With this is operated a horizontal, double-acting, rotative dry-air pump, with cylinders in tandem, protected by a water and air separator on the condenser head; also a motor-driven centrifugal pump for circulating the condensing water, and a small drain pump for automatically removing the condensation from the exhaust piping. The latter pump, however, is used only in emergencies, as the exhaust line is drained by a 3-in. pipe which runs down the shaft a vertical distance of 60 ft. and then turns up vertically for a distance of 17 ft. This automatically seals the vacuum and allows any accumulated water to drop down the shaft, as shown in Fig. 3. A 10-in. motor-driven centrifugal pump lifts the water from the hotwell to the top of a cooling tower from which it is returned to the injection system after being cooled as falling spray. Approximately 3125 gal. are used per minute.

There is a completely equipped switchboard, and current is led from the busbars to three oil-insulated, water-cooled transformers having a capacity of 500 kilovolt-amperes each, which step up from 2300 volts to 30,000 volts for transmission. As the transmission line will be operated when necessary at 60,000 volts, the transformer secondary coils are so wound that they may be easily changed to that voltage.

In addition to the generating unit, the station at the Maas mine contains two steam hoists and a two-stage air compressor furnishing 4800 cu.ft. of free air per minute. The Princeton station is similar to the Maas station.

The work is being carried out under the supervision of O. D. McClure, resident engineer for the company, and Viele, Blackwell & Buck, of New York, as consulting engineers.

The Barker District, Montana

By J. R. Villars*

The first discovery of ore in the Barker district, Montana, is said to have been made by accident in 1879, in the bed of Galena Creek, and for a number of years following the district was the scene of considerable activity. A large amount of ore was shipped and a smeltery was built to treat the ores. The latter are galena carrying silver, pyrite, some zinc and a small amount of gold. The orebodies occur either on contacts between limestone and porphyry or in the porphyry. In 1891 the railroad was completed and shipping to Great Falls was made possible. In 1893 the camp was practically abandoned and from that time until 1908 little was done except on a few claims by leasers.

Recent Operations

In 1908 the Barker Mines Co. was organized and incorporated for the purpose of taking over and working the Barker, Gray Eagle, Gibson Fraction, Belt and Defiance claims. Since that time this company has patented two more claims, the Phœnix and the Snow Drift. On the Barker claim the shaft was sunk to a depth of 400 ft., and the vein opened by drifts both east and west on the different levels. During the last summer a new hoisting plant was installed, consisting of engine, boiler, pumps and headframe; some money was also expended in building and repairing roads and in opening and patenting the Snow Drift and Phœnix claims. The company has shipped about 51 cars of ore, averaging about $40 per ton, to the American Smelting & Refining Co.'s works at Helena. This ore had to be hauled by wagon to Monarch, 12 miles distant, since the railroad spur from Monarch to Barker was taken up some years ago.

A 50-ton concentrator has been erected and was started on Nov. 16, 1911; this is reported to be working successfully. It consists of one Blake crusher; two sets of rolls, one for coarse and one for fine grinding; three Harz jigs and three Wilfley tables. The power is furnished by a 50-hp. engine and a 70-hp. boiler. Vanners will be put in later. The Great Northern Railway Co. has guaranteed to rebuild the line from Monarch to Barker as soon as this company guarantees shipments of 1000 tons per month; it is hoped that early in 1912 this can be done.

*Villars-Barnum Engineering Co., Great Falls, Mont.

Underground Development

The development work on the Barker claim shows the following results: The tunnel level driven west on the vein 1200 ft., shows 480 ft. of ore 3½ ft. wide; about one-third of this is shipping and the rest milling ore. The 175-ft. level driven 675 ft. west was in ore 3½ ft. wide for 400 ft. In places the orebody is 6 ft. wide and about one-third of this is shipping ore that will average over $40 per ton. The 300-ft. level, driven east 380 ft. and west 180 ft., was all in ore averaging 3½ to 4 ft. thick. On this level there is a solid streak of shipping ore about 1 ft. thick throughout the entire length of both the east and west drifts. The 400-ft. level for 250 ft. both east and west disclosed ore averaging about 5 ft. wide, about one-third of it being shipping ore. On this level there is a fair percentage of copper not shown in the upper levels. On the Gray Eagle claim the tunnel level opened milling ore for 250 ft. On the Phœnix a crosscut was driven to the south 280 ft., and a vein was cut having a width of 40 ft. A drift was then run 140 ft. to the west and the vein again crosscut, showing a width of 40 ft. The entire 140-ft. drift on this vein, as well as the two 40-ft. crosscuts, are in low-grade milling ore. Some native copper has also been found in this vein.

The Barker Mines Co. is a close corporation. Henry Tegtmeier is superintendent and C. N. Loring, formerly of Park City, Utah, is mill foreman. George B. Gunn, of Salt Lake City, president of the company, has made a number of trips to the properties at Barker, and has expressed himself as well pleased with the outlook. There are other properties in the Barker district that formerly were large producers of lead-silver ore, and it is hoped that with good management and proper development some of these old mines may be made productive again.

Serpek Process of Nitrogen Fixation

In the Serpek process for the fixation of nitrogen, bauxite is heated with coal to a temperature of 1700 to 1800° C. (*Journ. Soc. Chem. Ind.*, Nov. 30, 1911). From 15 to 18% of nitrogen is absorbed as aluminum nitride. When this nitrogen-bearing bauxite is treated with caustic soda, ammonia escapes and is caught, the profits from which materially reduce the costs of alumina and aluminum.

The Mining Index

A Classified Bibliography of the Current Literature of Mining and Metallurgy

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print), in the original language, for the price quoted. Where no price is quoted, the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittances are made in even dollars, we will return the excess over an order in coupons, if so requested.

COAL AND COKE

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17,875—CENTRAL AMERICAN MINES in 1911. T. Lane Carter. (Min. and Sci. Press, Jan. 6, 1912; 1½ pp., illus.) 40c.

17,876—CHINA—Mining in China in 1911. Thomas T. Read. (Min. and Sci. Press, Jan. 6, 1912; ½ p.) 40c.

17,877—COLOMBIA—Traveling in Colombia. R. D. O. Johnson. (Eng. and Min. Journ., Dec. 30, 1911; 2¾ pp.) 20c.

17,878—COLORADO—Metal Mining in Colorado in 1911. George E. Collins. (Eng. and Min. Journ., Jan. 6, 1912; 2 pp.) 20c.

17,879 — COMPRESSED AIR — Untersuchungstelle für Pressluftmaschinen. K. Wortmann. (Glückauf, Dec. 9, 1911; 1½ pp., illus.) Testing station for machines using compressed air at Consolidation colliery, near Gelsenkirchen. 40c.

17,880—COST ENGINEERING. Lewis B. Skinner. (Colo. School of Mines Mag., Jan., 1912; 5½ pp.)

17,881 — DIAMOND DRILLING — Surveying and Sampling Diamond Drill Holes. E. E. White. (Proc. Lake Superior Min. Inst., Vol. XVI, Aug., 1911; 21 pp., illus.)

17,882—DIVIDENDS—Mining Company Dividends in 1911. (Eng. and Min. Journ., Jan. 6, 1912; 2¼ pp.) 20c.

17,883—DRILLING — New System of Drilling in Stopes at the Jupiter Mine. (South African Min. Journ., Dec. 9, 1911; 1 p., illus.) 40c.

17,884—DUST—The Prevention of Dust in the Development Drives of Mines during Drilling Operations. C. J. N. Jourdan. (Journ. South African Inst. of Engrs., Dec., 1911; 2 pp., illus.) Discussion on paper previously indexed. 60c.

17,885 — EXPLOSIVES — Einiges über brizante Sprengstoffe. Neumann. (Zeit. f. angew. Chem., Nov. 24, 1911; 7½ pp., illus.) Some remarks on shattering explosives.

17,886—FILING NOTES—Keeping or Filing of Engineering Notes. R. Stuart Browne. (Trans. Am. Met. Soc., Dec., 1911; 4 pp.)

17,887 — FILING SYSTEM Suggested for Use of Engineers. H. L. Botsford. (Min. and Eng. Wld., 3¾ pp., illus.) 20c.

17,888—FILLING MINE WORKINGS under Railway Bridges with Concrete. C. L. Camp. (Eng. News, Jan. 11, 1912; 1 p., illus.) 20c.

17,889—FINANCE OF A MINE, The—VI. M. H. Burnham. (Min. Mag., Dec., 1911; 4 pp., illus.) 40c.

17,890—GERMANY—The Mining Industry in Germany. O. H. Hahn. (Eng. and Min. Journ., Jan. 13, 1912; 1 p.) 20c.

17,891—GREAT BRITAIN—Mining in Great Britain in 1911. (Eng. and Min. Journ., Jan. 13, 1912; 1⅛ pp.) 20c.

17,892 — HAULING — Die Verwendung von Stellwerken bei der elektrischen Lokomotivförderung unter Tage. Kliver. (Glückauf, Dec. 2, 1911; 2½ pp., illus.) The application of central safety switches in underground hauling by electric locomotives. 40c.

17,893—HEAD FRAMES for Small Shafts. Hugh G. Elwes. (Mex. Min. Journ., Jan., 1912; 1 p., illus.) 20c.

17,894—IDAHO—Mining in Idaho in 1911. Robert N. Bell. (Eng. and Min. Journ., Jan. 6, 1912; 1½ pp.) 20c.

17,895—ITALY—Bergbau und Hüttenindustrie Italiens im Jahre 1910. (Glückauf, Dec. 16, 1911; 5¾ pp.) 40c.

17,896—JALISCO—Mining in Jalisco in 1911. Austin C. Brady. (Eng. and Min. Journ., Jan. 13, 1912; 1 p.) 20c.

17,897—JAPAN—The Fujita Co., Osaka, Japan. (Far Eastern Review, Nov., 1911; 6 pp., illus.) 40c.

17,898—JAPAN'S MINERAL PRODUCTION. H. Foster Bain. (Min. and Sci. Press, Jan. 6, 1912; 2½ pp., illus.) 20c.

17,899 — LAWS — The Mineral Land Laws of the United States. James Douglas. (Min. and Sci. Press, Dec. 23, 1911; 2½ pp.) 20c.

17,900—LIGHTING BY CANDLES—The Cost of Illumination by Candles. Fred MacCoy. (Mex. Min. Journ., Jan., 1912; ½ p.) 20c.

17,901—MANAGEMENT—Principles of Mine Management. Charles A. Chase. (Eng. and Min. Journ., Dec. 30, 1911; 4¼ pp.)

17,902—MAPS—Electrical Symbols for Mine Maps. H. H. Clark. (Coal Age, Dec. 30, 1911; 3½ pp., illus.) Paper before Coal Mining Institute of America, Dec. 20, 1912. 20c.

17,903—MEXICO—Mining in Mexico in 1911. Kirby Thomas. (Eng. and Min. Journ., Jan. 6, 1912; 2½ pp.) 20c.

17,904—MINE ATMOSPHERE—Pathogenic Mine Atmospheres—I. Edwin M. Chance. (Coal Age, Dec. 30, 1911; 3 pp.) 20c.

17,905—MINING METHOD—Square Set Mining at the Vulcan Mines. Floyd L. Burr. (Proc. Lake Superior Min. Inst., Vol. XVI, Aug., 1911; 12 pp., illus.)

17,906—MINING METHOD—Top Slicing at the Caspian Mine. Wm. A. McEachern. (Proc. Lake Superior Min. Inst., Vol. XVI, Aug., 1911; 5 pp., illus.)

17,907—MINING METHODS—New Zealand and Nevada Mining Methods Compared. F. C. Brown. (Min. and Sci. Press, Jan. 13, 1912; 1¼ pp.) 20c.

17,908—MONTANA in 1911. F. L. Fisher. (Eng. and Min. Journ., Jan. 6, 1912; 1¾ pp.) 20c.

17,909—NEVADA—Mining in Nevada in 1911. (Eng. and Min. Journ., Jan. 6, 1912; 2½ pp., illus.) 20c.

17,910—OAXACA—Mining in Oaxaca in 1911. (Eng. and Min. Journ., Jan. 6, 1912; ¾ p.) 20c.

17,911—ONTARIO MINERAL OUTPUT in 1911. Thomas W. Gibson. (Eng. and Min. Journ., Jan. 6, 1912; 2½ pp., illus.) 20c.

17,912—ORE HANDLING—Modern Ore-Handling Methods in Spanish Mines. C. A. Tupper. (Min. Wld., Jan. 20, 1912; 2 pp.) 20c.

17,913 — PHILIPPINES — The Mineral Resources of the Philippine Islands, with a Statement of the Production of Commercial Mineral Products during the Year 1910. (Div. of Geology and Mines, Bureau of Science, Manila, P. I., 1911; 80 pp., illus.)

17,914 — PHOTOGRAPHY — Negative Making on Mexican Trails. M. MacFarlane. (Mex. Min. Journ., Jan., 1912; 1 p.) 20c.

17,915—PRODUCTION of Metals and Metallic Ores in 1909 and 1910. H. D. McCaskey. (Advance Chapter from Mineral Resources of the U. S., 1910; 8 pp.)

17,916—PRODUCTION, COSTS, ETC.—Data of the World's Principal Mines. S. F. Shaw. (Eng. and Min. Journ., Jan. 13, 1912; 3 pp.) 20c.

17,917—QUEBEC—The Mineral Industry in the Province of Quebec during 1911. Theo. C. Denis. (Can. Min. Journ., Jan. 1, 1912; 1½ pp.) 20c.

17,918—RESCUE WORK—Use of Oxygen Helmet in High Temperatures. H. H. Sanderson. (Mines and Minerals, Jan., 1912; ½ p.) 20c.

17,919—RHODESIA—Mining in Rhodesia in 1911. H. F. Marriott. (Eng. and Min. Journ., Jan. 6, 1912; 1 p.) 20c.

17,920—RUSSIAN EMPIRE in 1911. J. P. Hutchins. (Eng. and Min. Journ., Jan. 6, 1912; 3 pp.) 20c.

17,921—SHAFT—The Shape of a Shaft. E. Mackay Heriot. (Eng. and Min. Journ., Dec. 30, 1911; 2½ pp., illus.) 20c.

17,922—SHOVELS—The Use of Long and Short Handle Shovels. (Eng. and Min. Journ., Jan. 20, 1912; ¾ p.) 20c.

17,923—SIGNALLING—Recording and Signalling Device for Mines. John M. Johnson. (Proc. Lake Superior Min. Inst., Vol. XVI, Aug., 1911; 12 pp., illus.)

17,924—SOUTH AMERICA in 1911. (Eng. and Min. Journ., Jan. 6, 1912; 1 p.) 20c.

17,925—SPAIN—Mining Conditions in the South of Spain. Henry F. Collins. (Min. and Sci. Press, Jan. 6, 1912; 3 pp.) 20c.

17,926—STREAM DIVERSION—Diversion of the Sturgeon River at the Loretto Mine. Charles H. Baxter. (Proc. Lake Superior Min. Inst., Vol. XVI, Aug., 1911; 3 pp., illus.)

17,927 — SWEDEN — Schwedens Bergbau und Eisenindustrie im Jahre 1910. (Glückauf, Nov. 25, 1911; 3¾ pp.)

17,928—TAXATION of Mineral Rights in Michigan. P. B. McDonald. (Eng. and Min. Journ., Jan. 13, 1912; 1 p.) 20c.

17,929—TIMEKEEPING SYSTEM of the Crystal Falls Iron Mining Co. Jas. D. Vivian. (Proc. Lake Superior Min. Inst., Vol. XVI, Aug., 1911; 7 pp.)

17,930—TRACK ARRANGEMENT for Shaft Bottoms. Oscar Cartlidge. (Mines and Minerals, Jan., 1912; 1¼ pp., illus.) Four plans and their respective advantages for handling cars at foot of shafts. 20c.

17,931—TRANSVAAL—Mining in the Transvaal in 1911. Hugh F. Marriott. (Eng. and Min. Journ., Jan. 6, 1912; 2⅜ pp.) 20c.

17,932 — TUNNEL LINING — Grouting the Concrete Lining of the Rondout Pressure Tunnel. Herman L. Wittstein. (Eng. Rec., Dec. 30, 1911; 3 pp., illus.) 20c.

17,933 — TUNNEL SUPPORT — Steel Arch Supports in Tunnels. C. C. Semple. (Eng. and Min. Journ., Jan. 13, 1912; ⅜ p.) 20c.

17,934—TUNNELING—Driving the Big Savage Railroad Tunnel with Compressed Air. (Eng. Rec., Dec. 23, 1911; 1½ pp., illus.) An inrush of soft material prevented progress by customary methods and necessitated the use of air pressure for 200 ft. 20c.

17,935—TURKEY—Mining in Turkey in 1911. Leon Dominian. (Min. and Sci. Press, Jan. 6, 1912; 2 pp., illus.) 40c.

17,936—UTAH—Mining in Utah in 1911. Edward R. Zalinski. (Eng. and Min. Journ., Jan. 6, 1912; 2 pp.) 20c.

17,937—WOOD STAVE PIPES — Experiments on the Flow of Water in Wood Stave Pipes. (Proc. A. S. C. E., Dec., 1911; 13 pp.) Discussion of paper previously indexed.

ORE DRESSING—GENERAL

17,938—CONCENTRATION — The Future of Concentration. M. P. Boss. (Min. and Sci. Press, Jan. 6, 1912; ¾ p.) 20c.

17,939—CRUSHING—Feeding Boulders to Crushers. Claude T. Rice. (Eng. and Min. Journ., Jan. 20, 1912; 1 p., illus.) 20c.

17,940—PRUSSIA—Die Zentral-Erzaufbereitungsanlage der königlichen Berginspektion Clausthal im Harz. (Oest. Zeit. f. B. u. H., Dec. 9 and 16, 1911; 6¼ pp., illus.) The Central Ore Dressing Works of the Clausthal district in the Harz. Abstract from a paper by Schennen in Glückauf, 1907. 60c.

17,941—SCREENING—A Study of the Comparative Efficiencies of Certain Methods of Screening and Classifying Fine Material and a Comparison of Screened with Classified Feed on the Wilfley Table. J. R. Cox, G. G. Gibbons and J. B. Porter. (Bull. Can. Min. Inst., Oct., 1911; 71 pp., illus.)

17,942 — SEPARATION — Notes on a Simple Method of Separating Rock from Stiff Clays at Totok Gold Mine, Dutch East Indies. F. A. Killik. (Bull. 87, I. M. M., Dec. 14, 1911; 7 pp., illus.)

METALLURGY—GENERAL

17,943 — AUSTRIA — Die Bergwerks- und Hütteninduştrie Oesterreichs im Jahre 1910. (Glückauf, Dec. 9, 1911; 3¼ pp.) 40c.

17,944 — ELECTRIC FURNACE — Der elektrische Vakuumofen und seine Verwendung. O. Goecke. (Metallurgie, Nov. 8, 1911; 8¾ pp., illus.) The electric vacuum furnace and its use. 40c.

17,945—FLAMELESS COMBUSTION of Gas. William A. Bone. (Eng. and Min. Journ., Jan. 20, 1912; 4 pp., illus.) 20c.

17,946—FURNACE CHARGES—Calculation of Furnace Charges. Regis Chauvenet. (Met. and Chem. Eng., Jan., 1912; 3 pp.) 40c.

17,947 — REVERBERATORY FURNACES—Die Anwendung der Gesetze der Hydraulik auf die Berechnung der Flammöfen. (Stahl u. Eisen, Dec. 7 and 14, 1911; 10½ pp., illus.) Application of hydraulic laws to the calculation of reverberatory furnaces. 40c.

17,948—ROASTING—Efficiency in Ore Roasting. Arthur S. Dwight. (School of Mines Quart., Nov., 1911; 17 pp.) 60c.

17,949 — SILVER-LEAD SMELTING. L. S. Austin. (Min. and Sci. Press, Jan. 6, 1912; 1⅓ pp.) 40c.

17,950—SMELTER FUME — Beiträge zur Frage der Gewinnung des Flugstaubes aus dem Hüttenrauch. A. Rzehulka. (Zeit. Oberschlesischen B.- u. Hüttenmännischen Vereins, Oct., 1911; 5 pp.)

17,951 — WELDING — Symposium on Welding. Modern Welding Processes with Special Reference to Flame Welding. H. R. Cobleigh. (Journ. A. S. M. E., Jan., 1912; 31 pp., illus.)

17,952—WELDING—Thermit Welding. G. E. Pelissier. (Journ. A. S. M. E., Jan., 1912; 11 pp., illus.)

MINING AND METALLURGICAL MACHINERY

17,953—AIR COMPRESSORS—Operation of Air Compressors. E. A. Rix. (Min. and Sci. Press, Jan. 6, 1912; 1½ pp.) 20c.

17,954 — BELT CONVEYORS — Capacity and Speed of Belt Conveyors. (Eng. and Min. Journ., Dec. 30, 1911; 1½ pp., illus.) 20c.

17,955—BELTING—The Use and Care of Belting—IV. (Eng. Digest, Jan., 1912; 4 pp., illus.) 40c.

17,956—COAL HANDLING — Standard Boiler House and Coal-Handling System of the Crystal Falls Iron Mining Co., Menominee Range. J. S. Jacka. (Proc. Lake Superior Min. Inst., Vol. XVI, Aug., 1911; 6 pp.)

17,957—CONVEYING AND ELEVATING MACHINERY, Its Cost and Commercial Value.—IV.—Bucket Elevators. Reginald Trautschold. (Eng. Digest, Jan., 1912; 4 pp.) 40c.

17,958 — ELECTRIC FURNACE — The Present Status of the Electric Furnace. C. B. Gibson. (Elec. Journ., Jan., 1912; 2½ pp.) 20c.

17,959—ELECTRICAL OPERATION of the Plants of the Penn Iron Mining Co. Frank H. Armstrong. (Proc. Lake Superior Min. Inst., Vol. XVI, Aug., 1911; 9 pp., illus.)

17,960—GAS ENGINE—The Bituminous Gas Engine at the Groenfontein Tin Mine, South Africa. (South African Min. Journ., Dec. 16, 1911; 2½ pp., illus.) 40c.

17,961—GAS-ENGINE PLANTS — Colliery Gas Engine Plants. Frank C. Perkins. (Mines and Minerals, Jan., 1912; ¾ p., illus.)

17,962—GAS PRODUCER—Tests of a Suction Gas Producer. C. M. Garland and A. P. Kratz. (Univ. of Ill., Bull. 50, 1911; 91 pp., illus.)

17,963—GAS TURBINES—Ueber Gasturbinen. Langer. (Stahl u. Eisen, Oct. 19, 1911; 5 pp., illus.) 40c.

17,964—HOISTING—Electric Winding Gear at the West Rand Consolidated Gold Mines. (Engineering, Dec. 8, 1911; 2½ pp., illus.) 40c.

17,965—HOISTING—Electrically Driven Winding Machines. (A. E. G. Journ., Nov., 1911; 6 pp., illus.)

17,966—HOISTING — Neue elektrische Haspelförderung für schlagwettergefährliche Gruben. H. Reiser. (Bergbau, Nov. 23, 1911; ¾ p.) 20c.

17,967—HOISTING—Note on the Use of Induction Motors for Driving Winding Engines. H. J. S. Heather. (Electrician, Nov. 10, 1911; 1½ pp., illus.) 40c.

17,968—HOISTING — 5500-Horsepower Two-Cylinder Corliss Winding Engine. (Engineering, Oct. 27, 1911; 2⅜ pp.) 40c.

17,969 — HOISTING ENGINES — Electrically-Driven Winding Engines. Bertram Wood. (Aust. Min. Stand., Nov. 30, Dec. 7 and 14, 1911; 6 pp., illus.) 80c.

17,970—HOISTING MACHINERY—Untersuchungen an elektrisch und mit dampf betriebenen Fördermaschinen. (Glückauf, Dec. 2, 1911; 3 pp., illus.) Continuation of article previously indexed. 40c.

17,971—HOISTS—Electric Hoists for Mines. D. B. Rushmore. (Eng. and Min. Journ., Dec. 16, 1911; 2 pp.) From a paper read before Am. Min. Congress, October, 1911. 20c.

17,972—HOISTS—Electric Motors Versus Compressed Air Engines for Driving Deep-Mine Hoists. K. A. Pauly. (Bull. A. I. M. E., Dec., 1911; 28 pp., illus.)

17,973 — INTERNAL COMBUSTION ENGINE in Modern Practice. Robert L. Streeter. (Eng. Mag., Jan., 1912; 17 pp., illus.) Fourth article of series dealing with cost of power generation in small plants. 40c.

17,974—LOCOMOTIVE — Storage Battery Mine Locomotive at the Big Five Tunnel, Idaho Springs, Colo. H. B. Barnes. (Eng. and Min. Journ., Dec. 30, 1911; 1½ pp., illus.) 20c.

17,975 — MICROSCOPES — Universal Metalloscope—Perfected Microscope for the Examination of Metals. Albert Sauveur. (Bull. A. I. M. E., Dec., 1911; 11 pp., illus.) 40c.

17,976 — MINE EQUIPMENT — New Equipment at Negaunee Mine, Michigan. P. B. McDonald. (Eng. and Min. Journ., Dec. 16, 1911; ½ p.) 20c.

17,977—MOTOR TRUCK for Mines. Rex Beresford. (Eng. and Min. Journ., Dec. 9, 1911; ¾ p., illus.) 20c.

17,978 — POWER PLANT — The Ray Consolidated Power Plant. C. A. Tupper. (Eng. and Min. Journ., Dec. 2, 1911; 1¼ pp., illus.) 20c.

17,979 — PRODUCER-GAS PLANTS — The Internal Combustion Engine in Modern Practice. III. Machinery of Producer-Gas Power Plants. Robert L. Streeter. (Eng. Mag., Dec., 1911; 22 pp., illus.) 40c.

17,980—PUMPS—German Electric Mine Pumps. Robert Grimshaw. (Eng. and Min. Journ., Jan. 20, 1912; ⅜ p., illus.) 20c.

17,981 — PUMPS — Kreiselpumpen für Grubenwasserhaltungen. (Bergbau, Nov. 16, 1911; 1¼ pp.) Centrifugal pumps in mine drainage. 20c.

17,982—SAFETY DEVICES of the Oliver Iron Mining Co. Alex. M. Gow. (Proc. Lake Superior Min. Inst., Vol. XVI, Aug., 1911; 12 pp., illus.)

17,983—SKIP for a Vertical Shaft. (Min. and Sci. Press, Dec. 9, 1911; 1 p., illus.) 20c.

17,984 — STORAGE BATTERY for Goldfield Consolidated Mines. (Journ. of Elec., Power and Gas, Dec. 30, 1911; 3¾ pp., illus.) 20c.

17,985 — TURBO-COMPRESSORS — Pokorny and Wittekind Turbo-Compressors. (Engineering, Dec. 15, 1911; 3¼ pp., illus.) 40c.

SAMPLING AND ASSAYING

17,986—ANALYSIS—Rapid Methods of Technical Analysis. Frank D. Aller. (Colo. School of Mines Mag., Jan., 1912; 1 p.) Continuation of article previously indexed.

17,987 — ELECTRIC LABORATORY FURNACE. Raymond C. Benner. (Journ. Ind. and Eng. Chem., Jan., 1912; 3¼ pp., illus.) 80c.

17,988—MINE SAMPLING. S. F. Shaw. (Min. Mag., Dec., 1911; 3 pp., illus.) 40c.

17,989—NITER ASSAY CALCULATIONS, Graphic Methods for. Philip D. Wilson. (Eng. and Min. Journ., Dec. 30, 1911; 1 p., illus.) 20c.

17,990—SAMPLING—Principles in the Practice of Sampling. E. A. Hersam. (Trans. Am. Met. Soc., Dec., 1911; 3½ pp., illus.)

17,991—SPLITTING PULP SAMPLES, Device for. (Eng. and Min. Journ., Jan. 13, 1912; 1⅓ pp., illus.) 20c.

INDUSTRIAL CHEMISTRY

17,992—LITHOPONE — The Manufacture of Lithopone. (Eng. and Min. Journ., Dec. 16, 1911; 1 p.) 20c.

17,993—SULPHURIC ACID—Das Opl'sche Tumrsystem der Ersten Oesterreichischen Sodafabrik Hruschau zur Herstellung von Schwefelsäure 60 deg. Bé. Hartmann. (Zeit. f. Angew. Chem., Dec. 1, 1911; 2¾ pp., illus.) The Opltower system of the Ersten Oest. Sodafabrik. Hruschau for the manufacture of sulphuric acid of 60 deg. Bé. 40c.

17,994—SUPERPHOSPHATE — Manufacture of Superphosphate in Western Australia. M. W. von Bernewitz. (Min. and Sci. Press, Oct. 28, 1911; 1 p., illus.) 20c.

MATERIALS OF CONSTRUCTION

17,995—CEMENT — Die Entwicklung der Zementindustrie. Goslich. (Zeit. f. Angew. Chem., Sept. 15, 1911; 14½ pp., illus.) The evolution of the cement industry. 40c.

17,996—CEMENT—Retrogression in the Tensile Strength of Cement. J. M. O'Hara. (Proc. A. S. C. E., Oct., 1911; 6 pp., illus.)

17,997—CEMENT INDUSTRY in the United States in 1910. Ernest F. Burchard. (Advance Chapter from Mineral Resources of the U. S., 1910; 71 pp., illus.)

17,998—CEMENT MANUFACTURE — Utilizing Waste Heat of Rotary Kiln. H. E. Boyrie. (Cement Age, Dec., 1911; 4 pp., illus.) 20c.

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

T. H. Leggett has gone to Europe.

B. B. Lawrence has gone to Panama.

J. R. Finlay has returned to New York.

E. B. Kirby, of St. Louis, is visiting New York.

Courtenay De Kalb has been visiting mines in Oregon.

J. M. Garza Aldape, of Torreon, Mexico, is in New York.

Dr. Walter Harvey Weed was in Duluth, Minn., recently.

W. W. Mein is consulting engineer for the Dome Mines Co.

W. C. Ralston, of San Francisco, has been visiting New York.

William Crosley, of Chihuahua, Mexico, is on his way to London.

B. B. Gottsberger, of Miami, Ariz., expects to visit New York this month.

Fred T. Williams has been in the northern part of Utah on professional business.

Mark L. Requa, of San Francisco, has returned from a professional visit in Arizona.

A. N. C. Treadgold of Dawson, Yukon, was in New York last week, on his way to England.

Arthur Selwyn Brown has just returned to New York from a professional trip to Europe.

Alexander P. Rogers, of New York, is at present engaged in examination work in Arizona.

H. W. Turner passed through New York this week on his way from Siberia to San Francisco.

T. Lane Carter, of Chicago, recently lectured at Yale University, New Haven, Conn., on "Mining in Africa."

Ernst A. Sjostedt, of Sault Ste. Marie, Ont., is going to Europe for three months, to study the position of electric smelting there.

R. B. Brinsmade has opened an office for consulting work in mining and metallurgy at No. 7 Meson del Angel, Puebla, Mexico.

Joseph A. McDonald, late of the Ohio works of the Carnegie Steel Co., will go to the new Brier Hill Steel Co., as general manager.

Hoyt T. Gale, of the U. S. Geological Survey, engaged in exploration of potash deposits at Fallon, Nev., was in San Francisco recently.

H. B. Barling has been appointed manager in Honduras of the New York & Honduras Rosario Mining Co., at San Juancito, Honduras, Central America.

Arthur E. Woolsey, recently with the Illinois Steel Co. at South Chicago, has been appointed general superintendent of the works of the Tata Iron & Steel Co., at Sakchi, India.

Herman L. Schneider, for over six years with the Rio Tinto Copper Co. at Terrazas, Mexico, has resigned his position as manager and will be for the present at El Paso, Texas.

Sir William Mackenzie, president of the Canadian Northern Ry., and heavily interested in mining enterprises, has returned to Toronto after a month spent in England on financial busines.

Alonzo F. Bardwell has purchased the entire business of Bettles & Bardwell, assayers and chemists, Salt Lake City, Utah, since the recent death of Mr. Bettles. He will conduct the business for the present under the old firm name.

V. R. Garfias, of the U. S. Bureau of Mines, and W. F. Durand, of the mechanical engineering department of Stanford University, are at Bakersfield, Calif., for the purpose of studying the production and transportation of petroleum.

Frank McGovern announces that the partnership heretofore existing under the name of MacGovern, Archer & Co., has been dissolved by mutual consent and he has organized the corporation of MacGovern & Co., with offices at 114 Liberty street, New York.

George J. Henry, Jr., after an experience of 18 years with the Pelton Water Wheel Co., of San Francisco and New York, during the last 10 of which he was chief engineer, has resigned to open an engineering office at No. 737 Rialto Building, San Francisco.

S. T. Wellman of the Wellman-Seaver-Morgan Co., is in San Francisco recovering from a broken leg caused by an accident at the Heroult works of the Noble Electric Steel Co. Mr. Wellman had started for Cleveland when the accident occurred, for business purposes.

Albert Burch, Gelasio Caetani and Oscar H. Hershey announce that they have entered into partnership under the firm name of Burch, Caetani & Hershey, consulting engineers in mining, metallurgy and mining geology. Their offices are in the Crocker Building, San Francisco, California.

T. A. Jagger, Jr., professor of geology at the Massachusetts Institute of Technology, has been granted leave of absence for the remainder of the year, in order that he may perfect plans for the institute's volcanic laboratory at Halemaumau, in the Hawaiian Islands. He will spend several months on this work. The laboratory was in charge of Prof. Parret last summer.

C. M. Eye left Aroroy, Masbate, Philippine Islands, on Jan. 1, after two years' engagement as general superintendent for the Colorado Mining Co. During the period of this engagement, the mine was further developed and equipped to furnish 100 tons of ore per day, a jig-back tramway built, and a 20-stamp all-sliming cyaniding plant erected and put into successful operation. Mr. Eye will go to Europe and will be in New York about June 1, 1913. His address will be 1012 Sahwatch St., Colorado Springs, until further notice.

OBITUARY

Antonio Surial, a mineowner of Peru, who has been visiting this country, was killed at Newark, N. J., Jan. 23, in a trolley-car accident.

Harry C. Smith died at Morrison, Colo., Jan. 21, aged 35 years. He was born in Denver and graduated from the Colorado School of Mines in 1898. He was employed as a mining engineer at several places in Colorado, but recently purchased a ranch at Morrison.

Charles Leonard Hill died at Santa Monica, Calif., Jan. 20, aged 83 years. He was one of the best known mining men in the state of Colorado and a prominent factor in the mining history of the state. He was born in Maine in 1829. In 1860 he went to Colorado, crossing the plains from the Missouri River with an ox team. He went immediately to what was then the most promising mining camp in the state, Black Hawk and Central City, in Gilpin County. A few years later he went to Summit County and engaged in mining in Alma and Oro City. There he was appointed superintendent of the Printer Boy mine, operated by J. Marshall Paul, of Philadelphia, and acted in that capacity for several years. He then took charge of the Moose mine where he lived four years. In 1878 he went to Leadville and took charge of the A. Y. & Minnie mine. After leaving that mine he operated other mines at Leadville, where he resided for many years. Mr. Hill retired six years ago at the age of 77. In July, 1911, he suffered from an attack of paralysis, and was immediately taken to Santa Monica, where he remained until his death.

Societies and Technical Schools

Southern Oregon & Northern California Mining Congress—This body was to meet at Medford, Ore., on Feb. 2. This will be the second meeting of an organization of mining men, representing the counties near the California-Oregon line, whose commercial relations are divided between San Francisco and Portland. In practical mining the operators in Douglas, Jackson and Josephine Counties, in Oregon, and Siskiyou County, in California, are closely related. They are all producers of gold from placers and silicious ores, and have a common interest in the activity of the entire district. The sessions of the congress will occupy two days.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Jan. 24—The installation of the first new dredge in the California fields in 1912, at Oroville, by Lawrence Gardella on Jan. 12, has revived the discussion of the probability of redredging portions of that and other fields when there shall be demonstrated a device for saving the fine gold that is supposed to have escaped the standard types of tables employed in the operation of California bucket-elevator dredges. There are two positive opinions expressed on the subject: One, that there is not enough gold of any character remaining in the Oroville field so far dredged, to pay for the expense of the experiment; the other, that not only is there fine gold remaining, but that in many operations the gold contents that are capable of being saved by the methods employed have not been fully secured.

Should there be no redredging of the field, the Gardella dredge, Oro Vista No. 1, may be the last new boat installed at Oroville, as the number of dredges now in operation is equal to the present estimated life of the ground remaining to be worked. There have been various gold-saving devices offered for experimentation, but the larger operators have come to disregard them as of economic value when applied to boats of large capacity, the contention being that the results compared with the yield under the present method would not be commensurate with the necessary expenditure of installation and operation. There is one feature of the redredging possibility that is generally overlooked. That is the deepening of the field, particularly in the Yuba River district. The fact that the large boats in the field are digging 65 ft. below the water line is not evidence of limitation of the depth of the field. The prospecting drills in some instances indicated gold at 90- and 100-ft. depth.

A suit has been filed by the United States attorney at Los Angeles, to annul the patents to Southern Pacific R.R. lands in southeastern Kern County, on the line of the S. P. R.R. from Ventura to Mohave. The land is in the center of a gold-bearing mineral zone. It is generally supposed that when the Government attempts to recover mineral lands from the S. P. R.R. that the mineral is petrolific, but in this case there is not known to be any oil-bearing lands within the township described. The patent to these lands was issued in 1906, and hence it was necessary to begin suit within six years from that time. The usual charge of fraud is made in the complaint. It is common report that the Government purposes following up with similar suits all the lands of the railroad within the district, extending from a point a little north of the line between Los Angeles and Kern Counties, south to the Mexican line and east to the Arizona line. The railroad from Mohave to Needles is included in the district; it was built and operated as the Atlantic & Pacific R.R., but is now owned and operated by the Santa Fé R.R. The initial construction and ownership is said to have been a part of the Southern Pacific system, and that road controls the right to the lands in the railroad zone, but it has never obtained patents; an effort was made about a year ago to do this, but the Los Angeles Chamber of Mines and Oil interfered; since then the Government has made surveys of the region. Both oil and other minerals exist, though commercial quantities of oil have not been developed.

Butte

Jan. 24—It has been announced by Harry Gallwey, general manager of the Butte, Anaconda & Pacific R.R., after a conference with G. P. Armstrong, an electrical engineer of the General Electric Co.; Max Hebgen, manager of the Butte Electric & Power Co., and F. M. Kerr of the latter company, that the work of electrifying the road will begin soon, with the expectation of completing it within a year, at a cost of approximately $1,000,000. This move is a continuation of the policy of retrenchment being put in force by the Anaconda company, as several noteworthy economies will result, the chief one being the saving of fuel. The electric power used will be generated at the plant of the Great Falls Water Power Townsite Co., which is already supplying power to Butte and Anaconda. Seventeen new motors will be required for the line and they will be run by the overhead trolley system. Both the freight and passenger trains will be run in this way, the motors being the same type but geared differently for the two kinds of service.

On Jan. 18 at 11:00 a.m. it was discovered that the old Anaconda fire had broken out in a drift on the 600-ft. level of the Mollie Murphy shaft, in the fire zone between the Anaconda and St. Lawrence mines. The fire had been working along a vein of ore from the center of the Anaconda fire and it spread through the drift on the 600-ft. level to the south raise, where it attacked the timbers, creating a hot fire and causing a portion of the timbering to cave in. For a time the flames shot above the collar of the shaft, as it is an upcast air shaft, but by evening it had burned itself out. It was in the center of the fire zone and at no time endangered other properties, as bulkheads prevented it from spreading. No shutdowns or laying off of men occurred, and no harm was done aside from a small amount of timbering destroyed in the shaft.

Denver

Jan. 25—The flow from the portal of the deep-drainage tunnel is now about 9200 gal. per min. and within 10 months the water level of the district has been lowered an average of 85 ft. It is now headed for the Mabel M. or Gold Dollar watercourse which will probably be reached within the next 500 ft. The main volcanic or breccia area is about 1000 ft. beyond and when that is reached the main watercourse of the district will have been tapped and this great work completed. There is enough money on hand to drive the next 500 ft. and after that about $25,000 more will have to be raised in order to reach the main volcanic plug where it is believed an enormous flow will be tapped. The Strong mine has recovered its 10th level and the Portland is mining ore at its 15th level. The recession in the Battle Mountain section is about 4 in. per day.

Salt Lake City

Jan. 24—Fire at the loading station of the Daly West and Ontario mines Jan. 20, caused a loss estimated at between $10,000 and $20,000. The large iron doors at the mouth of the tunnel were closed to keep the mines from being filled with smoke. The tunnel usually carries an in-draft, but for some reason during the fire the current of air was in the opposite direction. There were no fatalities. The loading station was destroyed, and in addition there were burned about 200 tons of coal, $3000 worth of lumber, a sawmill and six railroad cars loaded with ore and concentrates. The building destroyed was constructed as a mill by the Ontario company in 1892, and was to have been equipped for the Russell process. It

was subsequently used as a loading station and spur tracks were built to it from the Denver & Rio Grande and the Union Pacific railroads. The Daly West mine and mill has closed down for a few days, on account of lack of space for storing ore and concentrates. It is thought that repairs will be completed by the first of the month or before, so that work and shipments can be resumed.

The tramway or elevator connecting the Bingham & Garfield R.R. passenger station with the town of Bingham in Carr Fork has been finished and was placed in operation Jan. 21. The incline is about 500 ft. from the cañon to the station and the difference in elevation is about 200 ft. vertical.

The mining costs at the Utah Apex for November were $3.37 per ton. The net smeltery returns on the shipments brought $10.94 per ton on the crude ore, and $11.96 on the concentrates. For the six months ended Oct. 31, 33,037 tons of ore and concentrates were produced, on which net profits of $77,266 were made. At present the output is 175 tons of milling ore and 100 tons of shipping ore per day. A lease has been given to Kirk & Leavell on the upper workings above the 400-ft. level, including parts of the Andy, Petro, York and Minnie claims, and the Phoenix section of the property. There are both copper and silver-lead ores in this territory. About 12 men have been put to work, preparing for active operations, and a large number of applications for subleases have been received.

Deadwood

Jan. 26—The annual report of the Homestake Employees Aid Fund has been made public, showing the following receipts: Balance in treasury, Dec. 31, 1910, $9569; from employees, $33,546; from Homestake company, $12,000; interest, $224; refund, account overpayment, $30; total, $55,396. Disbursements were: Death benefits, $20,000; injury benefits, $3205; sick benefits, $7277; insane benefits, $200. On Dec. 31, 1911, there was a cash balance of $14,686.

This fund is supported by a contribution of $1 per month from each employee of the Homestake company, and the company itself contributes $1000 per month. During the last year the employees averaged about 2900, and deaths numbered 25, or four-fifths of 1%. Not all of these deaths were the result of accident about the mine or plant. The Aid Fund pays a death benefit upon the demise of any member of the fund, no matter what the cause may be. This benefit is $800. Other benefits are paid for partial and total disability, in varying amounts, and for time lost through sickness or incapacity resulting from injury, the benefit is $1 per day.

The fund is administered by a board of directors elected by the employees from among their number. T. J. Grier, superintendent of the company, is treasurer. All clerical work, office room, stationery, etc., is furnished free by the company. The idea was fostered and promoted by Mr. Grier and officers of the company, and in the matter of benefits, and low cost to the laborer, the fund is one of the most liberal of any of the benefit associations maintained by large employers in the United States.

The recent purchase by Boston men of the Gladiator property, in Deadwood Gulch, is regarded as highly important, as the purchasers are preparing to develop extensively in a district which, up to the present, has received but slight attention, notwithstanding the fact that at numerous points ore stringers, giving high assays, have been discovered. The formation is almost entirely igneous, the principal instrusive being a fine-grained phonolite. Many of the veins carry fluorite and pyrite, and it is claimed that sylvanite has been identified. The ores have a striking resemblance to the Cripple Creek, Colo., high-grade ores.

Negaunee, Mich.

Jan. 26—The U. S. Steel Corporation has issued its annual pension report. The sum disbursed during the last year by its mining department in the Lake Superior region, the Oliver Iron Mining Co., amounted to $6936. The majority of this applies to the older Michigan mines, and over one-half, or $3736, went to former employees of the old Lake Superior mine at Ishpeming. The oldest man in point of service, whose name is on the pension roll, is Capt. John McEncroe, who has been at the Lake Superior mine for 53 years. This mine has shipped ore every year since 1857, amounting to a total of over 15,000,000 tons, and is reported in the appraisal of Michigan mines, by J. R. Finlay, to be good for 20 years more.

Cobalt

Jan. 26—Surveys for the extension of the Temiskaming & Northern Ontario Ry. into the Elk Lake district are being completed rapidly and it is expected that within a month the Temiskaming & Northern Ontario Ry. Commission will be in a position to call for tenders for the construction of the line. The route has not yet been definitely decided upon, but it is understood that the choice lies between a branch from the main line near Earlton, following the general direction of the present wagon road, and an extension of the present Charlton branch, the latter involving less outlay. On the Pearl Lake branch, steel has been laid for most of the way and the line will be run as far as the Timmins mine in a few days, after which work will be suspended until spring.

Toronto

Jan. 27—In that portion of the report of the Commission of Conservation of Canada, devoted to mine accidents, it appears that the death rates in Canada and the United States are greater than in any country for which statistics are obtainable. Moreover, the fatalities in Canada and the United States are known to be on the increase, while in Great Britain, Belgium, Prussia and France, there is a gradual decrease. During the period 1900-09, the average fatality ratio per 1000 in Canadian coal mines was 4.79, whereas in Belgium the highest rate for any year during the period 1901-08 was 1.16. During the '50s, the Belgian death rate was as high as the present death rate in Canada. The steady improvement is attributed to the combined efforts of the mine owners, the workmen and the Belgian administration of mines, and the diffusion of technical and professional knowledge. A factor in reducing fatalities due to gas and dust explosions has been the work of the Belgian testing station.

Porcupine

Jan. 26—The dissatisfaction of Temiskaming shareholders over the purchase of the North Dome property culminated recently in the holding of a meeting in Montreal, for the purpose of electing delegates to the annual meeting, to protest against the action of the directors. In reality the meeting was largely the result of another attempt to overthrow the Cartwright management. At the meeting it was disclosed that the directors had acted in a legal manner when they purchased the shares of the North Dome company and that even if the present management should be forced to retire, the bargain would still be binding. It was stated that while the Temiskaming company had paid $1.66 per share for the stock, 30,000 shares had previously been offered to a firm of New York brokers for $1 per share. Two of the shareholders were delegated to secure proxies from local shareholders with a view of electing new directors, the local men to act in conjunction with the dissatisfied shareholders in Buffalo and New York.

The *Ontario Gazette* has announced the incorporation of two new Porcupine mining companies with $3,000,000 as the aggregate capital.

There has been considerable delay in the operation of the electric line from Sandy Falls on the Mattagami River to Porcupine, owing to the slow arrival of the machinery, but some of the mines including the McIntyre, Vipond and McEnaney, have secured their supply of power, and the Hollinger and Pearl Lake will soon have completed their equipment. The advent of electric power will give a stimulus to the development of the Pearl Lake district.

The Mining News

The Current History of Mining

Alaska

It is reported that a large shipment of gold dust has been received at Seward, from Iditarod. This arrived by dog team and is *en route* to Seattle.

Alaska Gold Exploration Co.—The head office of the company is reported to have been transferred from Seattle to San Francisco. Members of the company, including Joseph H. Hutchinson, Judge J. P. O'Brien, John B. Coleman and S. I. Silverman, are said to have organized a holding company under the laws of California, known as the Turnagain Arm Co., which has taken control of the properties of the Alaska Gold Exploration Co., near the terminus of the Alaska Northern Railroad.

Big Kink—Justice Van Fleet, of the Federal Court of San Francisco, has rendered a decision in the suit of William Wehner against Alexander Bauer, of Chicago, growing out of the expenditure of money in the opening of hydraulic mines and installing a plant at this property. The suit has been in the courts for 10 years. Wehner will recover $60,000.

Seward Gold—This company is planning the installation of considerable new machinery as soon as the weather permits. F. W. Isham, Seward, is manager.

Alaska-Treasure — Operations have been resumed at this mine, under the direction of T. A. Harper, Juneau, and considerable work will be done this season.

Arizona

Gila County

Miami—The orebody has been cut on the 570-ft. level by the crosscut from the main working shaft at a distance of 580 ft. from the shaft. A churn drill is being set up near No. 3 shaft, about 1500 ft. northeast of the present developed orebody, and drilling will start soon. Surface indications are considered favorable to the development of another body of ore.

Live Oak—Shaft No. 2, near the western end of the property, will be enlarged from two compartments to three, and excavation is in progress for a new and larger hoist. A new air compressor will also be erected. This shaft is 928 ft. deep and the orebody has been shown to be over 200 ft. thick at this point, with an average copper content of 2¾ per cent.

Inspiration—Contracts have been signed for much of the material to be used in construction work during the next two years. W. H. Aldridge, managing director, Dr. L. D. Ricketts, representing the controlling interests in the company, and C. H. Repath, who will design the concentrator and other works for the Consolidated company, have visited the mines recently, and an announcement of the results of the examination and conference is expected soon.

Barney—The churn-drill hole in the bottom of the 400-ft. shaft, has been started, and drilling is proceeding steadily. The hole is in silicified schist, the ore-bearing formation of the Miami district.

Southwestern Miami—Churn-drill hole No. 2 is 440 ft. deep and progressing steadily.

Schultze—This group of 16 claims, five miles west of Miami, was bonded recently by L. D. McClure and H. E. Dunn for $250,000, for Eastern people. McClure and Dunn have left for New York.

Old Dominion—The Kingdon shaft has been temporarily retimbered for 175 ft., preparatory to putting in the concrete lining, which will be done in sections.

Mineral Farm Development—This company is developing the Mineral Farm group of 21 claims, three miles northeast of Globe. At a depth of 400 ft. in the vertical shaft, a crosscut is being driven north toward two veins that outcrop prominently for several thousand feet. The surface showings are considered favorable for the presence of sulphide ore at depth. Two miners and a hoisting man are employed. Robert H. Griffith is in charge of the work.

Iron Cap Copper Co.—Directors of this company, which is the reorganized National Mining & Exploration Co., have announced that subscriptions have been received for more than $25,000 of the proposed $50,000 bond issue under the offer to stockholders of Jan. 1. The new bonds are a first mortgage on the entire property. There is a present indebtedness of about $40,000. With the new bonds it is expected to discharge the mortgage and to retire the floating debt, leaving about $10,000 for working capital.

Superior & Boston—The crosscut north from the McGaw shaft, on the 12th level, is within a short distance of the vein and is purposely being advanced slowly so as not to cut the Great Eastern vein before the arrival of 200 ft. of 12-in. pipe for the water column between the 12th and 10th levels. When this is in place, everything will be in readiness to handle any flow of water that may be encountered upon cutting the vein. The present flow is about 750,000 gal. per day, most of which comes from the upper levels.

Santa Cruz County

In the Montana camp, William McDermott, formerly superintendent of the United Verde and lately manager of the Twin Buttes, and Captain Hoatson, of Calumet, Mich., and Bisbee, are opening a vein carrying gold, silver, copper, lead and zinc. Part of this at least makes an attractive milling ore, and it is expected that enough of this ore will be found to warrant a good-sized plant.

Old Dominion — Messrs. Craig and Stover, representing California capital, are opening this property with a 300-ft. shaft. This is a gold *antigua*, which had a record of shipments when this country belonged to Spain, and produced some high-grade ore about 20 years ago. The new interests have a bond on the group.

Ivanhoe—James Johnson, superintendent, is now shipping ore which he states is high grade. He has had assays of 10,000 oz. per ton silver.

World's Fair—It is stated that an option has been given on this mine for $750,000 by Frank Powers and wife, owners. The ore shipments from this mine average about $12,500 per car, mostly from silver contents. Copper is coming into this vein with depth, and there is a large body of milling ore that has not been touched.

Mineral Hill—John Allen, one of the owners of this group, has just shipped 100 tons of ore that runs high in silver with some copper. This mine is an *antigua*.

Austerlitz—This mine, in the Oro Blanco, is now being systematically developed by W. J. Partridge, for Los Angeles and Nogales men. The ore carries gold and silver, and there is a large body exposed, upon which the work is being done.

Arkansas

Southwestern Mining & Smelting Co.—This company has undertaken to develop a deposit of antimony ore in Sevier County, and will put up a smelting plant as soon as sufficient ore is taken out. George B. Hall, Rochester, N. Y., is president.

California

Amador County

Lincoln Consolidated—A stockholders meeting will be held on Mar. 16, to consider an increase in stock.

Keystone—A large supply of lumber and shaft timbers is being received; repairing the shaft is in progress.

Central Eureka—The mill has resumed operation with 20 stamps, after two months' idleness. It is proposed to keep the 20 stamps dropping while the mine is being prospected, and to put the 20 idle stamps in commission when sufficient pay ore is developed.

South Eureka—It is reported that negotiations for the sale of this mine to an English syndicate have been discontinued. Henderson Scott, of London, who appeared for the prospective purchasers, has returned to England.

Butte County

Ramona Mining & Leasing Co.—This is a new incorporation capitalized at $50,000. The directors are Fred R. Daniels, W. F. Pierce of Chico, E. A. Wilmunder of Sacramento. The head office is at Chico.

Union Mining & Power Co.—Articles of incorporation have been filed; capitalization, $500,000; directors, F. L. Hutchinson, C. M. Shrader, W. F. Aram, F. M. Read and W. A. Patterson.

Calaveras County

Penn Mining Co.—The county board of supervisors has decided to take no present action against this company at Camp Seco; the company is experimenting in a small way upon the treatment of the smoke from its McDougal roasting furnaces, by the "thiogen process," invented by Prof. S. W. Young.

Eldorado County

Pacific—Alexander Barring, of London, president of the Placerville Gold Mining Co., visited the mine and consulted with A. Barring-Gould as to the advisability of installing a mill. The mine is being extensively developed. The company owns mining property for a length of five miles in the Mother lode district.

Fresno County

Reports are insistent that the recent renewed activity at Dunlap is indicative of the development of a permanent gold camp. Three of the mines in the district are reported to have developed high-grade ore, the Brushy Ridge, Lucky Boy and Rose. The situation of the camp is on Mill Creek, where there is abundant water supply. The Dunlap district has the advantage of a year of prospecting and developing without attracting undue attention. There are no well authenticated reports of operations.

Dunlap Development Co.—This company contemplates the installation of a stamp mill on the property at Dunlap. Mr. Macdonald is superintendent.

Inyo County

Southern Belle—Forty tons of ore will be milled as a test run, both as to the value of the ore mined and the capacity of the mill which has been overhauled.

Mariposa County

Treasure—Five new stamps are being added to the mill. The plant is driven by electric power furnished by the San Joaquin Power Company.

Virginia—S. E. Lewis, former superintendent of the Crown Lead, has taken a lease on this property, purposing to develop it extensively. This is an old mine that was closed for some years on account of litigation.

Nevada County

Coan—The deepening of the shaft for 250 ft. from the 100-ft. level, is in progress.

Placer County

Pioneer—A large amount of ore has been mined ready for milling at this mine, near Alta, as soon as there is sufficient water.

Last Chance—The 5000-ft. tunnel through Eldorado mine ground into the Home Ticket is about completed. The Frankmount Mining Co., San Francisco, is the owner. W. S. Keith is consulting engineer.

Shasta County

Quartz Hill—It is reported that this mine will be closed temporarily by the Mammoth Copper Co., which has been operating it under lease. The quantity of ore required to be mined by the terms of the lease has been extracted for the present period.

Sierra County

Alaska—Machinery is on the ground to replace the power house and hoist recently burned, and the work of installing is being rushed.

Emerald—The arrastre on this group in Jim Crow Cañon has been completed and the crushing of high-grade ore has been begun by the owners, Smith & Shippsy.

Tightner—Unusually rich gold ore has been taken recently in quantity from this mine at Alleghany.

Ante Up—At this mine on the serpentine belt, near Mountain House, rich ore has been encountered while extending a new tunnel. Horace A. Morse is superintendent.

Sonoma County

Sonoma Magnesite Co.—This company is building a 12-mile railroad from its mines to Watson, on the Northwestern Pacific Ry. This gives a 70-mile haul to San Francisco. The mines will be opened in the spring, and include about 600 acres of land. The property contains both crystalline and amorphous magnesite; the former is used in the manufacture of steel and brick and the latter in the paper industry.

Ventura County

Russell—This borax mine, on the border of Kern County, is delivering borax at Bakersfield, for shipment on a foreign contract for 10,000 tons. Sixty mules are employed in the hauling, working in relays. About 3000 tons have been delivered.

Colorado

Boulder County

Milwaukee—This mine, at Sunnyside, is an instance of reclamation of old mines; the old workings have been placed in shape, a hoist installed and shipments commenced. There are 1200 ft. of levels driven from the main shaft.

Gold Bullion Mining Co.—This company was organized by Boulder men and capitalized for $1,500,000. A 75-ton mill, with Monell concentrators, is to be installed. The property includes the old Prussian group on Left Hand Creek, comprising the Prussian, Slide and Corning groups of 28 claims.

Cripple Creek District

Mary McKinney—This company, that has produced about $8,000,000 from its Mary McKinney mine in 19 years, is to be reincorporated next year, according to the laws of Colorado, as its charter was for 20 years. The main oreshoot has now been reached at a depth of 810 ft., and shipments are to be begun soon.

Moose—Seventeen tons of ore from the tunnel level of the Moose mine, on Raven Hill, have lately been shipped by Frank Guan, lessee, the returns being about $100 per ton.

Elkton Consolidated—The annual stockholders meeting will be held Feb. 12, at Colorado Springs. The company is capitalized for 3,000,000 shares, of which 500,000 are in the treasury. A dividend of 1½c. per month is paid, and the gross production up to Jan. 1 was $10,000,000. E. M. De La Vergne is general manager.

Golden Cycle—The company is reported to be enlarging its mill at Colorado City, in order to take care of the contracts of the United States Reduction & Refining Company.

Union Leasing Co.—The output for December from the Gold Sovereign and Mable M. was 57 cars.

Vindicator—The December output of this mine was 100 cars, 35 by lessees and 67 on company account, the latter averaging $35 per ton.

Lake County—Leadville

Garbutt—It is reported that a high-grade streak of ore has been opened in

this mine, on Bruce Hill. The mine adjoins the Little Jonny, which has long been a producer of gold.

Yak Tunnel—The ore shipments by lessees and on company account continue at about 10,000 tons per month.

Forfeit—Two cars of lead-carbonate ore per week are being shipped from this mine, in California Gulch. One shift of lessees is doing the work.

Famous—A small streak of gold ore is being mined by G. Bennet, lessee in this mine, Big Evans Gulch.

Ouray County

Camp Bird—Estimated net profit for December is £39,164; balance applicable to profit, £38,864. No. 2 drift west from winze No. 527 has been advanced 120 ft. in continuous ore of about 3 ft. average width and assaying $40 per ton.

San Juan County

Frisco Mines Co.—Charles Gagner, manager, has driven the Bagley tunnel 5800 ft., and has made a connection to surface through the Red Cloud workings; he is now seeking a proper milling system for the ores, which are lead, silver and zinc sulphides.

Highland Mary—This mine, operated by Daniel McLane and George Hill, has been shipping when conditions warranted. The mine produces argentiferous gray copper ore, averaging, crude, about $50 per ton. The orebody passes from the overlying andesite down into the schist, where good ore is developed 1200 ft. in vertical depth below the outcrop.

Summit County

Dunkin—From this lease, on Nigger Hill, near Breckenridge, a strike of carbonate-of-zinc ore, carrying gold and silver, is reported. T. H. Knorr & Co., are the lessees.

Kimberly-Wilfley—This lead-silver-zinc mine, at Kokomo, in which many Lake Superior men have been interested, has been purchased by Judge Patrick Flannigan, of Sagola, Mich., for $60,000, to protect his interests in the property. The latter includes about 100 acres of land and a partially completed mill. No dividends have been paid in recent years.

Idaho

Coeur d'Alene District

Knickerbocker—This company has finished sinking 200 ft. of winze. Good ore was encountered for the entire distance. An upraise to the surface will be driven, after which the mill will be started. The showing made thus far in the development is satisfactory.

Coeur d'Alene Standard—A contract has been let for 100 ft. of tunneling at this property, which is situated in Revenue Gulch, west of Wallace. Considerable work has already been done here and new work should help greatly in opening the orebody.

Federal—The contract for the erection of the building for the new Macquistentube plant has been let, and work has been started. The new equipment is expected to double the amount of zinc saved from the Morning ore.

Caledonia—Trouble with water is being met with in the first raise to the vein and has delayed the work. Three sets of contractors have given up their contracts. The main tunnel is within 250 ft. of the supposed position of the vein.

Michigan

Copper

Hancock—Sinking is going forward in the vertical shaft at a depth of about 3265 ft., having passed through the lode recently encountered and designated as No. 7. The opening made by the shaft showed the lode to be about 38 ft. thick, measured along the dip, and well mineralized throughout.

Indiana—The shaft is down about 590 ft., and is sinking in a felsite formation, showing an encouraging amount of copper. At 600 ft. a crosscut will be driven to cut the No. 9 drill hole, which revealed a good drill core at that depth. It is estimated that the drill hole is from 50 to 60 ft. from the shaft, horizontally.

North Lake—Breaking ground for a shaft has started near drill holes Nos. 3 and 7. No. 15 drill has been discontinued after sinking the sand pipe over 500 ft. in the overburden without striking bedrock.

Lake—The new shaft is down to the ninth level, where a station has been cut, and drifting will be started soon. Drifting is going on at all the levels below the third and the character of the ground being opened is fully up to any that has previously been exposed. The property is being put in shape and an early resumption of production may be expected.

Wyandot—The company will increase its operating force and will begin to open No. 8 lode, which is about 35 ft. wide and well mineralized throughout. The conglomerate recently encountered in the crosscut will be given attention as well as some of the other formations that have been exposed by the exploratory crosscut.

Victoria—Some good ground has been encountered in the new No. 6 shaft, at a depth corresponding to the 12th level of No. 2 shaft. At this level of No. 2 shaft, the east drift opened a good stretch of ground, which is probably the same as that exposed in the shaft, although the two are separated by about 2000 feet.

Mohawk—A partial shutdown is reported to have been caused by labor trouble. The point at issue relates to the proper care of rock drills and the proposal by the company to charge employees with the cost of repairs or breakage due to improper handling. The situation is not believed to be serious.

Iron

Iron River Steel Co.—This company has been incorporated recently, under Utah laws, to operate in the Iron River district. It is composed of Iron River mining men, and the following are officers: President, I. W. Byers; vice-president, W. H. Selden, Sr.; secretary, F. A. Morrison; treasurer, E. S. Coe; general manager, W. H. Jobe. The directors are I. W. Byers, W. H. Selden, F. A. Morrison, E. S. Coe, W. H. Jobe, Dr. E. M. Libby, N. E. Fisher, E. J. Van Ornum and Joseph Konwinski. The capital stock is $300,000. W. H. Jobe has resigned as district superintendent of Pickands, Mather & Co., to become general manager of the new organization.

McGreevy Iron Co.—This company has recently been incorporated under Utah laws, to operate in the Iron River region. Following are the officers: President and manager, J. C. McGreevy, of Duluth; vice-president, Capt. J. N. Porter, of Iron River; secretary, John B. Weimer, of Iron River; treasurer, A. E. Neff, of Gladstone. The directors are: J. C. McGreevy, Capt. J. N. Porter, John B. Weimer, A. E. Neff and James D. Pardee, of Salt Lake City. The company has options on the southwest quarter of Sec. 27—T. 43 N.—R. 35 W., and the northwest quarter of the northeast quarter of Sec. 34—T. 43 N.—R. 35 W. The former tract was held until lately by the Oliver Iron Mining Co., and adjoins the Buckholtz property of the Iron River Ore Co.; the latter tract lies just south of the Buckholtz and north of the Cortland property of the Wickwire Mining Co. Drilling will be carried on for the company by the Cole & McDonald Exploration Company.

Huron Mining Co.—At the Groveland mine of this company, four miles east of Randville and 24 miles north of Iron Mountain, the old shaft has been sunk to the fourth level; a crosscut will be driven to the new shaft and connected by raising. Exploration work continues at the McDonald property, at Crystal Falls; the shaft has been sunk to the fourth level, and a crosscut will be driven to the ore. At the company's Youngs mine, at Iron River, a winze is being sunk to the sixth level. At the Sec. 26 exploration, in the village of Iron River, a concrete dam is being put in on the first level, to catch surface water; sinking will be commenced soon. The river near-by makes the water problem a serious one. J. P. Diederichs is mining engineer for the Huron Mining Company.

Minnesota

Mesabi Range

Nashwauk—This mine, which is operated by the International Harvester Co., has closed down operations for the season, on account of severe weather conditions. B. W. Batchelder, superintendent, is in charge of the mine and of the new washing plant, which will be in operation at the commencement of the next season's work. Practically the only properties where stripping operations are being carried on are those operated by the Oliver Iron Mining Co., under the Hill lease.

Great Northern Ore—The annual report for the year ended Dec. 31, 1911, shows: Dividends, $2,365,434; surplus for year, $1,539,242; total surplus, $1,572,073. Under "old leases," the report shows: Tons mined in 1911, 1,758,182; average royalty, 17.3525c.; revenue, $305,089. Under Great Western Mining Co., the following figures were given: There were 5,344,078 tons shipped averaging 58.21% iron, on which the average royalty was 94.5c., and 155,681 tons, averaging 49% iron, on which the average royalty was 30c. per ton.

Montana

Butte District

East Butte—With a view of increasing its output to about 1,500,000 lb. per month, the company is making additions and improvements in its smeltery. It is planned to enlarge one of the furnaces by adding to its length, which is expected to give it a capacity of 500 tons of ore per day, and the plant a total capacity of 750 tons per day. The material for another 250-ton furnace has arrived and will be erected soon.

North Butte—During the last quarter, stations and skip chutes were completed on the 2600- and 2800-ft. levels of the Speculator shaft. Crosscutting has been started north and west on the 2600-ft. level and north and south on the 2800-ft. level. The south crosscut on the 2800-ft. level has encountered vein matter which seems to be part of the vein encountered in the shaft above the 2800-ft. level. A total of 4103 ft. of opening work was done during the quarter, in raising, sinking, drifting, crosscutting and station-cutting.

Jefferson County

Boston & Corbin—The ore in the drift on the 1200-ft. level is high-grade copper sulphide. A raise has been started from this level to open the ore to the 900-ft. level and to furnish air connections. A station is being cut on the 1300-ft. level, and a crosscut will be driven to tap the Bertha vein. Sinking will be resumed to the 1500-ft. level, a distance of 150 ft. from the present sump.

Madison County

Glenn—W. C. Hosking, of Missoula, associated with Missoula, Helena and Duluth men, has taken over this group of mines between Rochester and Camp Creek, the price being $35,000, and work will be started in about two weeks. The claims are the Madison, Star and Blue Jay gold properties.

Nevada

Comstock Lode

Ward—Good progress is reported in the Gold Hill drainage plans, the old north drift from the Bullion incline on the 2000-ft. having been entered for a distance of 150 ft., where further progress was prevented by a cave. Air is being forced into the workings by means of blowers, and the cave will be cleared away at once. The old bulkhead, which is the objective point, is about 600 ft. to the south, and it is believed it will be reached soon, when diamond drilling will be started from that point. All the territory to the north of the bulkhead has been well drained, and only a limited flow of water is now noted in the Gold Hill drainage drift.

Mexican—The new mill is running on about 50 tons per day and the heads are being gradually increased in grade. During the cleanup to be made, Feb. 1, a larger classifier will be installed, which is expected to bring the capacity up to 100 tons per day. A high percentage of extraction is being secured.

Belcher—Extensive preliminary work continues for future operations below the 1400 level. At the 1400, ground is being broken down over the incline shaft, preparatory to timbering for a large station. The blower station has been completed and foundations are now being constructed for air compressors. Low-grade ore is being extracted from north drift No. 2, on the 1400 level.

Elko County

Bourne—The mill is running steadily and is treating about 45 tons of ore per day. The grade of ore is improving and the shipments of bullion have increased. Development work is going on in the mine with the result that more ore is being blocked out.

Pavlak—The mill is treating a good grade of ore. In the mine connections are being made to improve the ventilation and these will be completed soon.

Buckeye—The company has bought off the contractor who had charge of the development work on this property and it is expected that the Syracuse, N. Y., men, who have an option on the property for $250,000, for 75% of the stock, will now take hold. The vein is showing a large quantity of milling ore with streaks of high grade.

Bluster-Success—At these properties which are under option to George Wingfield, about 30 miners are employed. Four tunnels on the Success have been driven on the vein, all showing good milling ore with a fair amount of high grade. At the Bluster the crosscut tunnel will soon cut the vein at a depth of about 300 ft. Good ore has been uncovered on both properties.

Alpha—This and the Flaxie, two of the large properties in the camp, are under option. Development work is being carried on.

Esmeralda County

Goldfield Consolidated—The production and operating expenses for the year 1911, are reported by dispatches as follows: Tons milled, 330,062; value, $10,586,936; tons shipped, 487; value,, $173,262; total production, 330,549 tons; total value, $10,760,198; loss in tailings, $597,071; realized, $10,163,127; net operating expenses, $2,498,450; operating profit, $7,664,677; deductions, $137,831; net operating profit for year ended Oct. 31, 1911, $7,526,846; amounting to 69.95% of the total production. For the year ended Oct. 31, 1911, the total earnings were $9,890,029; expenses, $2,363,183; and $7,526,846 operating profit after depreciation. The ore reserves on Oct. 31 are given as 600,000 tons, value not stated, but Superintendent Thorn states that the latter will be somewhat lower than in the past.

Nye County

Tonopah ore shipments for the week ended Jan. 18 were: Tonopah Mining, 3500 tons; Belmont, 2350 tons; Montana-Tonopah, 1015 tons; Tonopah Extension, 948 tons; West End, 700 tons; total, 8513 tons. Estimated value of shipments, $212,825.

Round Mountain Tungsten Mining & Milling Co.—The power line is reported to be completed and the transformers placed. Ore is being taken from the mine under the direction of Frank Anderson. The milling will be in charge of C. A. Homer.

Nevada Leasing & Ore Purchasing Co.—A meeting of the company will be held in Los Angeles soon to raise funds for remodeling the mill to suit the requirements of ordinary amalgamation and concentration. Stamps may be adopted for crushing. It is proposed to place the new mill on Ladd Mountain, at Rhyolite.

White Pine County

Nevada Consolidated—Three oil-fired reverberatory furnaces are reported to be in operation at the Steptoe plant. The plant includes five furnaces, but the change to oil fuel has increased the capacity so that now one and sometimes two furnaces can be held in reserve. The

new pumping plant is said to be working well.

New Mexico

Sante Fe County

Santa Fé Gold & Copper—On Jan. 1, the company had $27,984 in the treasury as compared with $38,832 on the corresponding date last year. President Westervelt has stated that both smeltery and mine have been idle during the year, as it was not deemed advisable to start operations on account of the high cost of coke and supplies. Ore reserves are said to be ample for four years. Treasurer Westlake says that expenses during the last year amounted to $13,280.

Sierra County

Rebate Mining Co.—The company is enlarging the engine and boiler room. Some extensive mining is being done, the shaft being down nearly 400 feet.

Dude Good Luck—At the property about six miles south of Lake Valley a new steel headframe is being erected. It is said that the 300-ft. shaft will be sunk to the 500-ft. level.

Socorro County

Ozark Smelting & Mining Co.—This company is the owner of the Graphic mines, and is a subsidiary of the Sherwin-Williams Paint Co.; a large tonnage of low-grade, complex, zinc-lead-iron sulphide ore is being developed. Experimenting with a flotation process is being done to find the best method of separating these ores.

Oregon

Dixie—About 50 tons of concentrates are reported to have been shipped to Salt Lake City recently, from this mine, 12 miles north of Prairie City, Grant County. Additional equipment will be installed.

McGuire—This hydraulic property in the southern part of Josephine County has been purchased by Daniel Hearne, of Grants' Pass, who is planning to operate it on a larger scale this spring.

Vanguard—Operations at this mine near Kerby, Josephine County, are to be resumed soon, with Samuel Bowden in charge. The camp is to be overhauled and new equipment installed as soon as possible.

Major Gilsan—This property in Baker County has been bonded to Marie Gifford, of Oakland, Calif., and considerable development work will be done.

South Dakota

Black Hills District

Gladiator—Boston men have purchased this property from the owners, Burt Rogers, R. N. Ogden and the estate of W. L. McLaughlin, of Deadwood, and will inaugurate a thorough and systematic plan of development in the spring.

Golden Crest—The funds realized from the recent assessment of 10c. per share will be used in paying off judgments which were secured last fall against the corporation.

Homestake—During 1911 the mines yielded 1,514,035 tons of ore from which bullion was recovered, worth $6,040,000. During the year $1,310,400 were paid in dividends, and large disbursements were made on account of the Spearfish hydro-electric plant.

Iron Creek Placer Mining Company—This company has been incorporated to install a hydraulic plant on Iron Creek, in western Lawrence County, and will start work early in the spring. Columbus, Ohio, men are furnishing the capital.

Utah

Beaver County

Red Warrior—Over four feet of carbonate ore has been cut on the 500-ft. level. The strike is regarded as important, indicating the continuance of pay ore on the deeper levels.

Horn Silver—The orebody on the 400-ft. level has been followed for 40 ft., and continues to open. Raising is being done on the ore and shipments are in progress.

Beaver Gold—This property, in the Newton district, has a shaft 50 ft. deep, and a vein of gold ore has been opened. The property is three-fourths of a mile north of the Sheep Rock.

Iron County

Gold Springs Mining & Power Co.—It is understood that arrangements for reorganizing or financing the company are being made in the East.

Bull Hill—This property is near the Gold Springs district, northwest of Modena, and 1½ miles east of the camp of Fay. A tunnel is reported to have cut a large quartz vein, carrying some gold and silver.

Juab County

Tintic shipments for the week ended Jan. 19 amounted to 179 cars.

May Day—More cars are available and shipments have been resumed. During the last week six cars were marketed.

Chief Consolidated—Shipments of high-grade ore running up to 135 and 260 oz. silver per ton have recently been made. Conditions are reported to be improving. Small net earnings are being made.

Gold Chain—There has been an improvement on the 700-ft. level. During the last week production was increased, and 12 cars were marketed. The 300 and 400 levels also have a good showing of ore. Operations are on a more efficient basis since the installation of new equipment.

Eagle & Blue Bell—A body of shipping ore has been opened on the 1300 level, and has been followed for 200 ft. A full face of lead-carbonate ore has been opened on the 700. The territory now being prospected is in the northern section and it is here that the new shaft is being sunk from the 1000 to the 1300.

Sioux Consolidated—The annual report has been mailed to stockholders. Ore sales for the year ended December, 1911, totaled 7884 tons, bringing $78,244, and dividends of $89,446 were paid. Including cash on hand at the beginning of the year, the total receipts were $160,654. Disbursements amounted to $159,940, leaving cash on hand, $714. The shaft was sunk 130 ft. during the year, making the present depth 600 feet.

Santaquin Chief—A vein carrying lead-silver ore has been cut in a short tunnel. In following this vein, a cross fissure carrying zinc ore was opened.

Salt Lake County

Montana-Bingham—The main tunnel, which is being driven toward the Bingham Amalgamated, is in about 900 ft., the greater part of this distance being in quartzite, which shows occasional copper stains.

Bingham-New Haven—A report recently issued shows that during 1911, 85,426 tons of ore were shipped and sold for $838,780. The net earnings were $546,446. Dividends of $228,689 were paid, all debts canceled and $133,128 charged off for depreciation. At the close of the year there was $188,565 cash on hand. During the last year the ore averaged 4.65%.

Tooele County

Bullion Coalition—Work is being done both on company account and by leasers. Ore is being mined from the 1600-ft. level and above, and is reported to run well in lead and silver. The company is earning more than expenses.

New Stockton Mining & Milling—Work has been started on the old Ben Harrison mine by Campbell & Reese, who have taken a lease and bond.

Wisconsin

Winskell—This mine, at Shullsburg, is working a breast of ore 45 ft. high and 120 ft. wide, and is one of the largest producers in the field since outside interests secured it.

Fox—This mine, at Benton, owned by the New Jersey Zinc Co., has a face of ore 410 ft. wide by about 20 ft. high.

Cleveland—This mine, at Hazel Green, which was thoroughly drilled before the shaft was started in old lease diggings, has one of the finest plants in the district. The ore face is 75 ft. high and 100 ft. wide, and the concentrates run 50 to 54%. Some of the ore sheets are 1 ft. thick.

Canada

ONTARIO

Ophir Consolidated Mines Co.—This company has been organized, with $5,000,000 authorized capital, and head office in Toronto, to take over the old Ophir property, Lake of the Woods, and to operate it on a more extensive scale.

ONTARIO-COBALT

Cobalt shipments for the week ended Jan. 26 were as follows: La Rose, 130,580 lb.; Cobalt Townsite, 130,580; Nipissing, 70,500; McKinley-Darragh, 63,600; Hudson Bay, 62,840; Buffalo, 58,920; Crown Reserve, 45,900; total, 562,920 pounds.

Doctor Reddick—The stamp mill is steadily in operation at this Larder Lake mine, all the ore extracted being put through. When the orebody is sufficiently opened a Hardinge mill will be added to the plant.

Harris-Maxwell—A 40-stamp mill is being erected on this property at Larder Lake. It is expected that hydro-electric power will be available early in April.

British-American—A reorganization of this company is being undertaken. The capital will be reduced from $2,500,000 to $1,000,000, of which $200,000 will be preferred stock to be issued to shareholders at 5c. per share.

Calcite Lake Mining Co—This company at Elk Lake has been fined $100 and costs for a breach of the Mining Act. On Dec. 26 Sigmund Terdk, a miner, fell out of a bucket in the shaft and was killed, the accident being caused by the striking of the crosshead in the shaft. An investigation by the mine inspector showed that the mine was not equipped with a safety appliance so arranged that on the crosshead sticking the bucket would also stop. The company made no defense.

Trethewey—The output of this mine during 1911 totaled 716,464 oz.; $273,486 total value.

Crown Reserve—The annual report for 1911 shows: Value of the production for the year, $1,833,516; net profits, $1,279,739; dividends, $1,061,288; total surplus, $764,851 and $500,000, estimated value of ore on dump.

Wettlaufer-Lorrain—The report for the year ended Dec. 31, 1911, shows that 925,017 oz. of silver were shipped, having a net value of $464,901. The cost, including equipment expenditures, was 19.89c. per oz. Profits were $313,390. A new orebody, recently opened, is expected to add materially to the reserves. The company has acquired an option on the Keeley mines and the Silver Eagle and has purchased outright an undivided one-tenth interest in the Curry silver mines.

ONTARIO-PORCUPINE

Jupiter—Good ore has been discovered on the 200-ft. level of No. 2 vein. The vein is about 4 ft. wide.

Night Hawk Lake—This company has commenced operations on its newly acquired properties in Langmuir Township.

East Dome—Work has been started on these claims and a small plant will be installed.

Northern Ontario Exploration—A crosscut from the shaft at No. 1 camp at the 150-ft. level has encountered a 5-ft. vein. At the 100-ft. level this vein was 1 ft. wide.

Schumacher—A series of testpits are being put down on a gold-bearing quartz vein that has been stripped for 250 feet.

West Dome—In No. 3 shaft, 10 ft. of mineralized schist carrying sulphides have been cut at the 100-ft. level, being the same shoot that dipped out of the shaft at 75 feet.

Dome Extension—Gold-bearing stringers have been encountered at 90 ft. in No. 4 shaft and in drifting on the 100-ft. level from No. 8 shaft.

Dome—The stamp batteries and tanks are in place at the mill. The new compressor is working and good progress is being made in blocking out ore on the 50-ft. level.

Porcupine Gold—The 12-drill compressor is running with power from Sandy Falls, operating six drills. No. 3 vein at the 200-ft. level has been cut and found to be 20 ft. wide, with ore similar to that on the 100-ft. level. No. 2 vein has been drifted on for 120 ft. at the 200-ft. level. Raises will be commenced soon to block out the ore.

Mexico

CHIHUAHUA

San Toy—For the year ended Dec. 31, 1911, the gross receipts were $769,525; net, $496,493; dividends, $360,000, and $136,493 surplus.

JALISCO

Mololoa—During 30 days recently the company shipped 120 tons of rich ore to the Aguascalientes smeltery. A thousand tons of this ore went to the El Favor plant for milling, and a silver extraction of 86% and a gold extraction of 98% were obtained by cyanidation. A reduction plant will be built by the company.

El Favor—Sixty drillers are at work on the upper levels, stoping high-grade ore for shipment to the San Luis Potosi smeltery. One hundred mules are in service packing the ore to Magdalena, the shipping station. The seventh level is being driven east with the expectation of opening bodies of sulphide ores.

Casados—Shipments of high-grade ore from the Casados mine, of the Consolidated Mining Co., have been resumed. The ore shipped is taken out in the course of development, no stoping being done. Much development has been accomplished during the last few months.

Espada—The company has a large tonnage of high-grade milling ore ready for the Marquetas mill, which is under lease. An aërial tramway from the mines to the mill has been completed, and milling will be in progress soon.

Magistral—A drift on the second level has opened an oreshoot 10 ft. wide, averaging from 7 to 8% copper. Some of the ore runs higher. A crosscut from an old drift has cut the same shoot, 70 ft. ahead. The company has resumed sinking the double-compartment shaft.

Almoloya y Anexas—A new oreshoot has been opened in this mine, and the company's small concentrating plant is again in operation. The ore runs from 4 to 5% copper.

MICHOACAN

Dos Estrellas—This company produced in 1911 ore worth approximately 11,000,000 pesos. Definite reports for 11 months show a production of 10,067,697 pesos from 435,317 tons of ore milled. The best month was June, when the output reached a value of 1,175,120 pesos. In March and September, the output also exceeded 1,000,000 pesos. The profits during the 11 months reached a total of 5,563,487 pesos. During the year 6,000,000 pesos were paid in dividends.

South America

CHILE

Braden—The old mill has been increased in capacity, and since Aug. 1, 1911, has been treating about 350 tons per day. The normal capacity of 500 tons is expected to be reached soon. The new mill has been in operation with three units for two months, each unit treating 500 tons per day. The second section was to have been completed in January, and the third in February. The blast furnace is treating concentrates, and the converter will soon be turning out blister copper. The experimental lixiviation and electrolytic plant is well advanced. Three of the six units of the hydro-electric plant are in operation and are transmitting to the mine, 25 km. distant. The electric railway connecting the mine and reduction plant has been working satisfactorily for some time. About 3000 men are employed at present.

Africa

WEST AFRICA

Gold production of the Gold Coast and Ashanti is reported by the West African Chamber of Mines for the year ended Dec. 31 at 185,493 oz. bullion in 1910, and 261,784 oz. in 1911; an increase of 76,291 oz. The bullion reported in 1911 was equal to 251,560 oz. fine gold, or $5,199,752 in value.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

Coal Trade Review

New York, Jan. 31—Interest in the West seems to be centered on the Indianapolis meeting. The miners have definitely asked for an increase of 10c. per ton on the wage scale and for shorter hours. A conference is now going on between committees composed of eight miners from each of the districts—Western Pennsylvania, Ohio, Indiana and Illinois—and of eight operators from each district. The matter was complicated a little by the demand of the operators from the Fifth and Ninth districts of Illinois to be considered a separate division, apart from the rest of the state. The outcome of this conference is quite uncertain.

Trade is rather more normal, though there is still much complaint about the slowness of transportation and difficulty in obtaining cars. The same conditions rule in the East. Stormy weather has also delayed the coastwise trade materially.

It is reported that British dealers are seeking options on large quantities of West Virginia coal, which may be needed in case of a general strike of the British miners.

Coal and coke carried over all lines of the Pennsylvania R.R. east of Pittsburg and Erie, year ended Dec. 31, short tons:

	1910	1911	Changes
Anthracite	11,596,233	11,957,149	I. 360,916
Bituminous	41,497,912	42,419,445	I. 921,533
Coke	12,822,695	10,639,107	D. 2,183,588
Total	65,916,840	65,015,701	D. 901,139

The increase in coal was 2.4 per cent., and the decrease in coke 17 per cent.; the total showing 1.4 per cent. decrease for the year. In 1911 anthracite was 18.4 per cent. of the total tonnage; bituminous, 65.3; and coke, 16.3 per cent.

Iron Trade Review

New York, Jan. 31—Conditions have changed little in the iron and steel markets. A fair business is being transacted, though less than in the December spurt. Prices have not improved much, in some lines not at all. Specifications on contracts are coming in well, and mills are generally busy. Several large orders for rails have been placed.

In pig iron a moderate business has been done. Foundry and basic iron especially have been in demand. Prices do not advance; in the Central West, especially, there seems to be a general move to hold down the merchant furnaces to present quotations.

The owners of the Great Northern ore lands have filed their individual answers in the suit against the Steel Corporation, to which they were made parties. They claim that their leases were simply business transactions, made without any desire or intention to aid or establish monopoly.

A semi-official statement says that in 1911 the United States Steel Corporation made approximately 10,750,000 tons of pig iron and 12,770,000 tons of steel ingots. The output of finished steel products was about 10,250,000 tons. This shows a decrease from 1910 of about 1,080,000 tons of pig iron and 1,400,000 tons of steel ingots.

The bill amending the tariff on iron and steel has passed the House of Representatives by a large majority, a number of the insurgent Republicans voting for it with the Democrats. Practically no amendments were made to the bill as introduced.

United States Steel Corporation—The statement for the December quarter is as follows, net earnings being, as usual, the balance after paying operating expenses and ordinary repairs; comparisons are with the December quarter of 1910:

	1910	1911
Net earnings	$25,990,978	$23,105,115
Depreciation and replacement funds	$5,528,518	$3,126,594
Interest and sinking funds	7,311,963	7,311,963
Total charges	$12,840,481	$10,438,557
Surplus	$13,150,497	$12,666,558
Adjustment of accounts	83,766	81,780
Surplus for the quarter	$13,066,731	$12,748,338

From this surplus in 1911 appropriations were made for dividends on preferred, $6,304,919; common stock, $6,353,781; total, $12,658,700, leaving an undivided balance of $89,638 for the quarter. No appropriations were made for new work. This statement completes the year, making the net earnings $104,355,563 for 1911, against $141,143,941 in 1910; $131,479,975 in 1909, and $91,847,710 in 1908. After payment of preferred dividends in 1911, the balance was equal to 5.9 per cent. on the common stock.

Pig-Iron Production—Pig-iron production in 1911, as reported by the American Iron & Steel Association, was 23,649,344 gross tons, agreeing closely with the forecasts. This was a decrease of 13 per cent. from 1910, the record year, and 1911 yields in tonnage to 1906, 1907, 1909 and 1910. Bessemer pig iron decreased 16 per cent., and basic pig iron 6 per cent., which is quite in alignment with the precedents, as bessemer steel has been steadily losing ground ever since the basic openhearth process appeared. From the pig-iron figures it may be estimated roundly that production of bessemer steel ingots and castings in 1911 was about 8,000,000 gross tons, and of basic openhearth steel ingots and castings about 14,000,000 tons, indicating, with allowance for 1,000,000 tons of acid openhearth steel, and perhaps 250,000 tons of miscellaneous steel, a grand total of steel ingots and castings for the year of about 23,000,000 tons.

Baltimore

Jan. 29—Exports for the week included 219,800 lb. iron ore to Leith, Scotland; 43,300 lb. lead and 5,386,854 lb. miscellaneous iron and steel to Panama. Imports included 60 tons spiegeleisen and 3739 tons ferromanganese from Liverpool; 6500 tons manganese ore from Bombay, India; 6700 tons iron ore from Cuba; 52 casks barytes from Bremen.

Birmingham

Jan. 29—There is a little business still being transacted by Southern iron manufacturers, one trade during the past week being reported at 26,000 tons, delivery extending over six to eight months. The prices are around $10.25 per ton, No. 2 foundry, and there is considerable firmness at that figure. Inquiries are being received which indicate there will be need for a large tonnage of iron before the year is out. The production is still off. During this week the Sloss-Sheffield Steel & Iron Co. will blow in a furnace to replace the one which met with an accident last week and which will be out of the running for several months. There will be no effort made to increase the make until the demand is stronger. While there has been considerable iron sold ahead, there is not a great tonnage disposed of for immediate delivery. As far as can be learned, there has been no trouble experienced in making deliveries in this section of the country. The weather has not been so bad either as to affect the outdoor work to any great extent.

Southern manufacturers are still

worrying in reference to the freight rates and are hoping for relief through the Interstate Commerce Commission. During the past week representatives of the Interstate Commission sat in New Orleans and heard the complaint raised at that place anent the rate of $3 out of the Birmingham district. Shortly there will be filed with the commission a request to bring about a reduction of at least $1 per ton in rates from the Birmingham district to the Ohio gateway points. The consumers from the Middle West have joined with the independent iron makers in the South in the effort to get a reduction in rates.

Announcements are made of more orders for steel rail. The steel plants are doing well. There is a slight improvement in steel-wire products, and prices are up.

Chicago

Jan. 29—Quiet conditions continue in the iron market, with a waiting mood evident in both buyers and sellers of pig iron and finished products. The sales of pig iron in the last week have been encouraging; two or three contracts have been for more than 1000 tons, but in general the foundry melter on whom this market depends is buying in small quantities and often.

Sales of pig iron are mostly for first-half delivery, with an increasing though small number running into third quarter and last half. No. 2 Southern still sells for $10 Birmingham, or $14.35 Chicago, as a minimum, and No. 2 Northern for $14. There are some large inquiries out which may make large sales in a few days. The market for Lake Superior charcoal iron has been depressed in the last week, the quoted price of $16.50 having been shaded 50c.@$1, but effect on the coke foundry-iron market has been small.

For iron and steel products the market continues to be fairly good. Structural material shows a good aggregate tonnage each week. Railroad supplies continue doubtful, though one purchase of 2500 tons by a Chicago transfer line has given the market an appearance of activity.

Soft steel bars, for some time the weak point in the local market for finished products, are selling at 1.25@1.33c. Chicago, these prices cutting out Pittsburg competition almost wholly. Plates are quiet and sheets active, at unchanged prices. Billets show no change. Wire products sell lightly as a result of the recent advance in price.

Philadelphia

Jan. 31—Active interest in the pig-iron market has temporarily subsided and makers express satisfaction with the outcome of the business of the first month of the year. No unusual development is now looked for until near the time when buying for the second quarter will be necessary. Makers are a little concerned at the efforts of two or three Southern concerns to get second or even third-quarter business. Low-grade iron for pipes, however, keep selling well and some exceptionally large orders have been placed with more in sight. Central Pennsylvania furnaces are already low in stocks. On the whole pig-iron consumption is increasing. No. 2 X foundry is around $15 for both Northern and Southern. Forge sold at $14.25; basic quoted at $14.25 per ton.

Steel Billets—The week has passed without notable transactions. Open-hearth is quoted at $22.40 delivered, with business in sight; forging billets around $27 with the usual hand-to-mouth sales.

Bars—Operations at mills have not been seriously interfered with—but cold weather has interfered with deliveries. Jobbers are still sorting up.

Pipes and Tubes—A general improvement in tubes has set in but only for urgent wants.

Plates—Some of the largest inquiries for some time have been gone over within a week. The local and all eastern shipyards have been good buyers; car-building orders have helped out. Quotations 1.30@1.35c. New business is offering daily.

Structural Material—New business covered a dozen or more orders for early delivery chiefly.

Scrap—With better weather the scrap yards will be filled up from country sources. The week's sales show an improvement.

Pittsburg

Jan. 30—Conditions in the iron and steel trade have shown no material change from a week ago. If there has been any change at all, it has been in the direction of slightly more pronounced quietness. This is a disappointment to the trade, which, before the holidays, looked for a continuance of the activity which marked November and the fore part of December, while, furthermore, when quietness set in just before the holidays, the expressed expectation was that the fore part of January would be quiet, with a general loosening up in the second half of the month. This has certainly not occurred.

Apparently the only cases in which there has been an improvement during January has been in the case of steel mills which insisted upon closing strictly upon the date the contracts they had expiring Dec. 31, such mills naturally experiencing a lull in the early part of January, with which the latter part makes a favorable comparison. Other mills, which did not construe contracts so closely, have seen no material improvement during the month, and in some cases the specifications received in the second half of the month have not been as heavy as in the first half.

Prices of finished-steel products have shown no material change in the week. They are fairly well maintained all along the line, but slight weaknesses in plates and sheets, already observed, are a trifle more pronounced. Hoops are being sold by two of the local producers at 1.25c., in the case of attractive orders, while the leading interest adheres to 1.30c. The important contracts with large consumers, of course, were made at less than 1.30c.

Pig Iron—A Cleveland consumer has purchased 10,000 tons of basic iron, for delivery over the next three months, at $13.15, delivered. Half came from a Cleveland furnace with a 25c. rate and the other half from a Sharpsville furnace at a 90c. rate, making the price at Valley furnace $12.25, and this may now be quoted as the minimum of the market. Some odd lots have been sold at about 5c. concession from the usual asking price of $12.50. Bessemer iron is definitely quotable 25c. lower, on the basis of one or two sales recently made at cut prices, but small lots still bring $14.25, Valley. Foundry iron is quiet, but there is no particular effort to sell and the price is maintained. Malleable iron is distinctly firmer. We quote: Bessemer, $14@14.25; basic, $12.25@12.50; foundry, $13@13.25; malleable, $13@13.25; forge, $12.50@12.75, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburg.

Steel—Two mills in Youngstown are ready to sell bessemer billets and sheet bars, and the market is lower as compared with the nominally advanced prices recently quoted, $20 for billets and $21 for sheet bars, Pittsburg. The leading Pittsburg producer is entirely out of the market, but another Pittsburg producer would probably sell some tonnage. We quote bessemer billets at $19 and bessemer sheet bars at $20, Youngstown, quotations for Pittsburg on both bessemer and openhearth being $19.50@20 for billets and $20.50@21 for sheet bars. Rods are quotable at $25, Pittsburg, with occasional quotations at $26 per ton.

Ferromanganese—The market continues quiet. The price is well maintained but very little interest is manifested. We quote $41, Baltimore, for prompt and forward, freight to Pittsburg being $1.95 per ton.

Sheets—The occasional shading already noted has increased somewhat, and on desirable orders some of the mills are regularly cutting the openly recognized prices $1 a ton. Tonnage is good with some mills but poor with others, the market being in an unusually mixed condition. We quote regular prices at 1.90c. for black, 2.90c. for galvanized, 1.40c. for blue annealed, $1.33@1.35 per square for painted corrugated and $2.47@2.50 for galvanized corrugated.

St. Louis

Jan. 30—The market continues to improve slowly, both for pig iron and finished products. Pig orders are rather larger in quantity, as a rule. Northern No. 2 foundry sells at $14.50@15, St. Louis. Southern No. 2 is held at $10.25, Birmingham, or $14, St. Louis. The bulk of the business has been in Southern iron.

Sault Ste. Marie Canal Traffic

The total business of the Sault Ste. Marie canals for the season is reported as below. All freights are in short tons, except salt, which is in barrels. Mineral freights are included in the totals:

	1910	1911	Changes
Freight carried..	62,363,218	53,477,216	D. 8,886,002
No. of vessels....	20,899	18,673	D. 2,226
Average cargo....	2,983	2,865	D. 118
Minerals			
Coal	13,513,727	15,332,876	I. 1,819,149
Iron ore	41,603,634	30,731,235	D.10,871,399
Pig and mfd. iron	444,669	412,269	D. 32,400
Copper	148,070	132,481	D. 15,589
Building stoe.....	9,635	5,342	D. 4,293
Salt, bbl.....	528,610	764,308	I. 135,698

In 1911 there were 11,870 vessels passed through the American canal and 6803 through the Canadian. The American canal was open Apr. 24 to Dec. 16, or 237 days; the Canadian, Apr. 22 to Dec. 13, or 238 days.

Iron Ore Trade

The Canadian-Venezuelan Ore Co., of Montreal, has so far advanced in the work on its Imataca iron-ore deposits on the Orinoco River, in Venezuela, that it will be able to ship from 10,000 to 15,000 tons monthly. The ore is a hard hematite, running about 65 per cent. iron, 0.035 to 0.045 phosphorus and 2.5 to 3 per cent. silica. It is being offered to Eastern furnaces on the basis of about 8c. per unit. Naylor & Co., of New York, are the sales agents for the United States. Some sales of trial lots have been made.

British Iron and Steel Trade

Exports and imports of iron and steel, and of machinery, in Great Britain, year ended Dec. 31, are valued by the Board of Trade returns as below:

	Exports	Imports	Excess
Iron and steel	£43,751,618	£11,144,211	Ex. £32,607,407
Machinery...	30,977,408	5,769,274	Ex. 25,208,134
Cutlery and hardware..	10,221,680	6,708,637	Ex. 3,513,043
New ships....	5,662,045	.....	Ex. 5,662,045
Total..... ..	£90,612,751	£23,622,122	Ex. £66,990,629
Total, 1910..	91,544,552	19,917,125	Ex. 71,627,427

Decrease in exports, £931,801; this was entirely in new ships. Increase in imports, £3,704,997, almost entirely in crude iron and steel. The quantities of iron and steel exports and imports were, in long tons:

	1910	1911	Changes
Exports	4,588,009	4,579,109	D. 68,900
Imports	1,367,343	1,764,489	I. 397,146

Tinplate exports to the United States decreased from 73,619 tons in 1910 to 13,997 tons last year.

METAL MARKETS

New York, Jan. 31—The metal markets have not been especially active, and no important changes are noted.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold:			
Dec. 1911..	$ 994,677	$ 4,707,330	Exp. $3,712,565
" 1910..	1,330,400	4,976,632	Imp. 3,646,232
Year 1911..	37,183,074	57,445,184	Imp. 20,262,110
" 1910..	58,774,822	59,222,518	Imp. 447,696
Silver:			
Dec. 1911..	5,997,360	3,306,727	Exp. 2,690,630
" 1910..	6,061,060	4,398,450	Exp. 1,662,61g
Year 1911..	65,664,646	43,746,571	Exp. 21,918,073
" 1910..	57,360,973	45,878,168	Exp. 11,482,805

Exports from the port of New York, week ended Jan. 27: Gold, $160,200; silver, $786,998, chiefly to London. Imports: Gold, $499,910, principally from Mexico; silver, $92,858, largely from Central and South America.

Gold—The price of gold on the open market in London was unchanged at 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. There was some demand for India and Egypt. In New York $500,000 gold was taken for Costa Rica, on French account.

Platinum—The market is a little unsettled, but prices are unchanged. Dealers still ask $46 per oz. for refined platinum and $48.50 per oz. for hard metal.

Our Russian correspondent writes, under date of Jan. 18, that the market is unchanged. The present uncertain position is believed here to be the result of a struggle between the foreign refiners and the Société Industrielle de Platine, which controls about 55 per cent. of the Russian production. Current prices are 9.95 rubles per zolotnik—$37.41 per oz.—for crude metal, 83 per cent. platinum, at Ekaterinburg; and 38,500 rubles per pood—$37.73 per oz.—for the same grade at St. Petersburg.

Silver—The better outlook in the China situation, together with the demand from India, indicate a reasonable probability that silver may show some advance from present quotations.

SILVER AND STERLING EXCHANGE

Jan.	25	26	27	29	30	31
New York....	57¾	57¾	57¾	58⅛	58¼	58¼
London ..	26 9/16	26 9/16	26 9/16	26¾	26 13/16	26 13/16
Sterling Ex..	4.8730	4.8745	4.8750	4.8740	4.8740	4.8730

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to Jan. 18, reported by Messrs. Pixley & Abell:

	1911	1912	Changes
India.....	£ 312,500	£315,300	I. £ 2,800
China.....	116,000	110,000	D. 6,000
Total.....	£ 428,500	£425,300	D. £ 3,200

India Council bills in London averaged 16.09d. per rupee for the week.

Copper, Tin, Lead and Zinc

NEW YORK

Jan.	Copper		Tin	Lead		Zinc	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
25	14¼ @14⅜	14.00 @14.10	42⅞	4.45	4.32½ @4.37½	6.40 @6.50	6.25 @6.35
26	14⅛ @14¼	13.85 @14.00	42⅝	4.45	4.32½ @4.37½	6.40 @6.50	6.25 @6.35
27	14⅛ @14¼	13.80 @13.90	42⅝	4.45	4.32½ @4.37½	6.40 @6.50	6.25 @6.35
29	14⅛ @14¼	13.80 @13.90	43	4.45	4.32½ @4.37½	6.40 @6.50	6.25 @6.35
30	14⅛ @14¼	13.75 @13.85	42¾	4.25	4.12½ @4.15	6.40 @6.50	6.25 @6.35
31	14⅛ @14¼	13.85 @13.90	42⅞	4.25	4.12½ @4.15	6.40 @6.50	6.25 @6.35

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market; for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Jan.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
25	62⅛	62 1/16	66½	194	192	15⅝	26⅜
26	61 15/16	62¾	66¼	193	191	15⅝	26⅜
27	.....	.....	.....	.....	.....	.....	.....
29	60 15/16	61 9/16	65¾	194¾	192¼	15½	26⅜
30	61¾	62⅛	65¾	194½	191½	15⅝	26⅜
31	62 1/16	62 1/16	66¼	194¾	192¼	15⅝	26⅜

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—Early in the week of Jan. 25-31, the conditions materialized that were indicated at the end of the previous week. While certain agencies that have well filled their books were continuing to quote a price "asked," others were seeking business and making concessions to secure it, but carefully refraining from signaling their operations by any blowing of horns. Even sharper concessions were made by second hands. It was natural after a period of this policy, during which buyers failed to evince any great interest, that the mere

desire to sell should become converted into pressure. This happened about Jan. 26, when one of the leading agencies made drastic cuts in its efforts to consummate business with foreign buyers, in which it was followed by three other agencies. Those who continued to remain out of the market stuck to their asking price of 14½c., delivered, usual terms, but might as well have called their price 15@16c. The agencies soliciting business sold at 14c., delivered, usual terms, corresponding to about 13.85c. cash New York as late as Jan. 26, and upon Jan. 30 sales were made as low as 13.90c., delivered, usual terms, corresponding to about 13.75c. cash, New York. On Jan. 31 there was a little rally. The business in Lake copper during the week was practically nothing and quotations for this kind are consequently but nominal. The Lake producers have not yet cut their price, and, of course, have been unable to sell in competition with electrolytic under the conditions of the last week. Lake from second hands has been freely offered at 14¼c. without attracting buyers. At the lower level of price for electrolytic business increased somewhat, but the volume of transactions was by no means of unusual proportions. The market closes uncertain at 13.85@13.90c. for electrolytic copper in cakes, wirebars and ingots, while Lake is altogether nominal at 14⅛@14¼c. Casting copper is quoted nominally at 13½@13⅝ cents.

The standard market reached the low point on Jan. 29, when spot was quoted at £60 16s. 3d. and three months at £61 11s. 3d. At this level, the bears decided to take profit, and under the stimulus of their purchases the market advanced, closing steady at £62 3s. 9d. for spot, and £62 18s. 9d. for three months.

Copper sheets are 19@20c. base, for large lots. Full extras are charged and higher prices for smaller quantities. Copper wire is 15¾c. base, carload lots at mill.

Copper exports from New York for the week were 11,994 long tons. Our special correspondent gives the exports from Baltimore at 2433 tons.

Official reports give the quantity of copper smelted in Russia in the nine months ended Sept. 30, 1911, at 1,121,257 poods, or 40,434,014 lb.; an increase of 86,801 poods over the previous year.

Tin—The market in London displayed a firm tone. Good-sized orders were placed by American interests during the latter half of last week, but with the beginning of this week the markets both here and abroad have become dull. There were no arrivals of tin in this port, and none are expected for about a week, so that spot supplies are becoming very small again and are subject to a premium of about 1c. per lb. The market closes firm at £194 15s. for spot, and £192 5s. for three months in London, and about 42⅞c. in New York for February tin.

Lead—Rather unexpectedly to the trade at large , the American Smelting & Refining Co. announced a reduction in its price on Jan. 30 of $4 a ton, which the independent sellers met. The market closes unsettled at 4.25c., New York, and 4.12½@4.15c., St. Louis.

The London market is again lower, the close being cabled at £15 11s. 3d. for Spanish lead, and £15 13s. 9d. for English.

Spelter—The market is quiet, but current orders are still in sufficient volume to take care of the amounts which are unsold for near-by shipment. The close is unchanged at 6.25@6.35c., St. Louis, and 6.40@6.50c., New York.

The London market has had a decided decline, closing at £26 2s. 6d. for good ordinaries, and £26 7s. 6d. for specials.

Zinc dust is quoted at 7⅜@7½c. per lb., New York.

Base price of zinc sheets is $8 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Other Metals

Aluminum—Business continues steady and quotations hold at 19@19½c. per lb. for No. 1 ingots, New York. The foreign market is reported firm at about 12c. for ingots.

It is stated that an addition to the reduction plant at New Kensington, Penn., will be erected by the Aluminum Co. of America.

Antimony—Business has been quiet during the week. The price of Cookson's has been reduced and is now 7¼c. per lb. Hallett's is unchanged at 7⅜@7½c., while 6¾@7c. per lb. is still named for Chinese, Hungarian and other outside brands.

Quicksilver—The market is strong. New York quotation is still nominally $43, but an advance is expected very shortly. San Francisco also nominally unchanged. The London price has been advanced 5s. to £8 5s. per flask, with £8 2s. 6d. quoted from second hands.

Bismuth—The syndicate which controls the European production quotes 7s. 6d.—equal to $1.80—per lb. in London. In New York a quotation of $1.72 per lb. is made for metal produced from American ores.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Nickel—Large lots, contract business, 40@45c. per lb. Retail spot from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

Zinc and Lead Ore Markets

Platteville, Wis., Jan. 27—The base price paid this week for 60 per cent. zinc ore was $46@46.50. The base price paid for 80 per cent. lead ore was $58 per ton.

SHIPMENTS, WEEK ENDED JAN. 27

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point	714,100	.....	.....
Galena	678,900	.....	.....
Benton	581,850	.....	301,600
Platteville	457,700	66,000	.....
Hazel Green	382,300	.....	.....
Shullsburg	230,790	.....	.....
Cuba City	230,240	.....	.....
Highland	105,400	.....	.....
Montfort	72,000	.....	.....
Rewey	61,000	.....	.....
Total	3,514,280	66,000	301,600
Year to date	11,537,960	192,560	655,600

The letter of Jan. 20, delayed in the mails, reports base price of 60 per cent. zinc ore, $45@46; no lead sales. Shipments for the week, 2,980,520 lb. zinc ore and 217,100 lb. sulphur ore. Deliveries to concentrating plants, 1,051,750 lb. zinc ore.

Joplin, Mo., Jan. 27—The highest price paid for zinc sulphide ore was $50 per ton, the base, per ton of 60 per cent. zinc, $44@47. Zinc silicate sold at $24@27 per ton of 40 per cent. zinc. The average price, all grades of zinc, was $42.16. Lead sold as high as $60 per ton, the

SHIPMENTS, WEEK ENDED JAN. 27

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	3,209,420	.....	1,048,800	$103,201
Joplin	1,582,860	.....	171,210	41,555
Alba-Neck	1,016,620	.....	63,370	25,759
Galena	429,010	.....	126,370	13,165
Granby	64,600	921,160	24,050	12,520
Duenweg	344,130	.....	47,250	9,135
Spurgeon	65,820	270,060	80,520	7,430
Miami	212,530	.....	55,200	5,665
Oronogo	261,090	.....	.....	5,004
Jackson	130,820	.....	65,660	4,810
Aurora	209,890	.....	.....	4,195
Carthage	185,790	.....	.....	4,087
Carl Junction	146,980	.....	.....	3,675
Cave Springs	119,690	.....	.....	2,630
Lawton	65,850	.....	.....	1,480
Totals	8,045,100	1,191,220	1,682,430	$244,311
1 mo	32,436,300	1,708,400	5,010,390	$894,168
Blende val., the week,	$180,285;	1 mo.,		$720,485
Calamine, the week,	14,500;	1 mo.,		22,015
Lead value, the week,	49,526;	1 mo.,		148,668

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January	$41.85	.....	$40.55	.....	$55.68	.....
February	40.21	.....	39.16	.....	54.46	.....
March	39.85	.....	38.45	.....	54.57	.....
April	38.88	.....	37.47	.....	56.37	.....
May	38.25	.....	36.79	.....	55.21	.....
June	40.50	.....	38.18	.....	56.49	.....
July	40.75	.....	38.36	.....	58.81	.....
August	42.50	.....	41.28	.....	60.74	.....
September	42.63	.....	41.29	.....	59.33	.....
October	42.38	.....	40.89	.....	54.72	.....
November	45.40	.....	43.25	.....	57.19	.....
December	44.13	.....	40.76	.....	62.03	.....
Year	$41.45	.....	$39.90	.....	$56.76	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

greater bulk of the sales being at $58@59, with the average price of all grades $58.86 per ton.

The heavier portion of the winter for this region is over, and the ground has thawed until it is said to be without a bottom off of the macadam roads. This, and a shortage of cars, is holding back shipments that would otherwise have made the week an exceptionally heavy one for the season. One of the features of the better weather is the reopening of a number of the abandoned mines in the Chitwood group, adjacent to Joplin. Some new developments are being made on the old level, but the greater evidence of a new record comes from a lower level that is now being easily drained, the large pumps, four miles away, being given credit for this change.

Chemicals

New York, Jan. 31—The general trade is fair, but there is no special activity.

Copper Sulphate—Business is steady and prices are unchanged. Quotations are $4.90 per 100 lb. for carload lots, and $5.15 per 100 lb. for smaller orders.

Nitrate of Soda—A little better business is reported, but quotations are the same as last week. Spot nitrate is 2.20c. per lb.; while 2.20c. is asked for futures up to July 1, and 2.17½c. for deliveries after that date.

Sulphate of Ammonia—Production of sulphate of ammonia in Great Britain in 1911 was 378,500 long tons. Exports were 292,000 tons; home deliveries, 85,500; total, 377,500 tons. Stocks, Dec. 31, were 13,000 tons.

Arsenic—Demand continues good and prices are a shade firmer. For white arsenic $2.50@2.75 per 100 lb. is asked.

Petroleum

The buying price of best quality Pennsylvania crude oil was advanced this week to $1.50 per barrel. This is the fourth advance since Dec. 24, when the price was $1.30. A further advance is expected.

Mining Stocks

New York, Jan. 31—On Jan. 25, stocks on the Exchange were quiet, with light dealings and few changes. On the Curb all mining stocks were slow, with a light demand for copper shares and only small variations in prices.

Jan. 26 the tone of the Exchange was variable and unsettled, some prices advancing and others receding. On the Curb, Cobalt and Porcupine stocks were more active. Inspiration Copper sold largely, but other coppers were rather quiet.

On Jan. 27 trading on the Exchange was slow and no pronounced tendency was developed. On the Curb trading was not at all active, and mining stocks were rather neglected.

Jan. 29 the Exchange showed more activity. There was a considerable selling movement and prices on some of the active stocks showed a weaker tendency. Mining stocks on the Curb were more active, especially the coppers, in which a good business was done at small and irregular price changes. Cobalt and outside stocks were inclined to be weaker.

On Jan. 30, the general market was stronger and the tendency upward. Business on the Curb was quite active, especially in the coppers. Cobalt stocks about held their own. On Jan. 31 there was little change, trading being rather quiet on both Exchange and Curb, with the tendencies unchanged.

There was one sale of Homestake at $90 per share.

At auction in New York, Jan. 25, a lot of $400 Rex Carbon Coal Co. bonds, lumped with some minor securities, brought $100 for the lot; 962 shares Shenandoah Iron & Coal Co., $100 par, $105 for the lot; 4000 shares Old Hundred Mining Co., $5 par, $2 for the lot; 8000 shares Vulcan Mining, Smelting & Refining Co., $1 par, $6 for the lot; 100 shares Bismarck Consolidated Mines Co. preferred and 1000 shares common, $90 for the lot.

Boston, Jan. 31—Copper-share prices have weakened with the metal market, but aside from this there is an absence of outside interest, with some exceptions, which goes to make a lazy market. Old Colony and Mayflower continue in the limelight, although transactions in the main are more or less speculative and professional. Both have had substantial reactions yet show a firm tone. Mayflower ranged from $6.75 to $10 during the week and Old Colony from $5.75 to $7.50. Franklin, Victoria and Algomah have also come in for considerable attention as recent developments in the Lake Superior territory tend to strengthen the positions of these properties. Franklin, after expending over $250,000 in equipping its No. 1 shaft with a new and enlarged hoist, expects to commence production at the rate of 5,000,000 lb. per annum.

Indiana, after a $3 jump to $15, lost a good portion of it. Inspiration continues active, although at slight price changes. The new Consolidated stock has been transferred from the Curb to the Stock Exchange. The Cole-Ryan stocks all carry a heavy tone in sympathy with the weakness of Amalgamated. Arrangements have been perfected to introduce a portion of the share capital of Chino and Ray Consolidated on the Paris Coulisse. About 200,000 shares of each are available. These will follow Utah Copper stock, which was given a quotation in Paris some time ago.

Curb trading has been active in spots, but generally at lower prices. Rhode

COPPER PRODUCTION REPORTS.

Copper contents of blister copper, in pounds.

Company	October	Nov.	Dec.
Alaska shipments.	2,704,802	1,274,655	4,995,008
Anaconda	21,400,000	20,850,000	.....
Arizona, Ltd.	2,720,000	2,960,000	3,100,000
Balaklala	.....	.....	.....
Copper Queen	7,786,218	6,946,775	8,365,265
Calumet & Ariz.	4,784,000	4,390,000	4,486,000
Detroit	2,086,624	1,941,498	1,969,313
East Butte	920,000	983,405	.....
Mammoth	1,865,846	1,793,181	1,721,404
Miami	.....	.....	2,500,000
Nevada Con.	5,547,931	5,207,983	4,679,674
Old Dominion	2,050,000	2,082,000	2,610,000
Ray	2,069,287	2,517,000	2,660,000
Shannon	1,124,000	1,256,000	.....
South Utah	326,578	361,681	267,514
United Verde*	2,750,000	2,500,000	2,000,000
Utah Copper Co.	8,660,729	9,117,961	9,039,557
Lake Superior*	18,440,000	18,600,000	17,500,000
Non-rep. mines*	13,564,713	11,483,000	.....
Total production.	98,800,728	94,265,139	.....
Imports, bars, etc.	22,960,027	17,224,725	.....
Total blister	121,760,755	111,489,864	.....
Imp. in ore & matte	4,137,431	4,767,217	.....
Total	125,898,186	116,257,081	.....
Brit. Col. Cos.:			
British Col. Copper	778,586	.....	.....
Granby	.....	.....	.....
Mexican Cos.:			
Boleo	1,245,440	.....	2,645,640
Cananea	5,804,000	.....	3,706,000
Moctezuma	1,719,643	1,682,768	2,864,464
Other Foreign:			
Cape Cop., S. Africa	.....	857,920	.....
Spassky, Russia	672,000	685,440	.....
Famatina, Argen.	.....	174,720	.....
Exports from:			
Chile	4,816,000	4,704,000	5,824,000
Australia	7,056,000	7,168,000	11,200,000
Arrivals in Europe from other count.†	11,782,400	12,064,640	16,331,840

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
Year 1910	1,452,122,120	749,426,542	722,431,494
I, 1911	115,696,591	42,078,557	53,208,739
II	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year, 1911	1,431,938,338	709,611,605	754,902,233

VISIBLE STOCKS

	United States	Europe	Total
I, 1911	122,030,195	236,629,120	358,649,378
II	142,439,490	236,992,000	379,431,134
III	156,637,770	233,385,600	390,023,009
IV	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. From Jan. 1, 1911, stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

Island Coal struck a low level at 25c. As yet the plan of reorganization has not been issued. United Verde Extension took a perpendicular drop from 73 to 52c., with partial recovery.

Assessments

Company	Delinq	Sale	Amt
Algomah, Mich	Jan. 22		$1.00
Alta, Nev	Jan. 26	Feb. 16	0.05
Andes, Nev	Feb. 7	Feb. 28	0.05
Black Jack, Utah	Feb. 6		0.01
Boston Ely, Nev	Jan. 18		0.50
Bruns. C. Y. M., Nev	Jan. 12	Feb. 2	0.02
Bullion, Nev	Jan. 12	Jan. 29	0.05
Confidence, Nev	Jan. 16	Feb. 6	0.20
Con. Imperial, Nev	Jan. 16	Feb. 7	0.01
Crown Point, Utah	Feb. 15	Mar. 11	0.005
Exchequer, Nev	Feb. 14	Mar. 6	0.05
Federal Ely, Nev	Jan. 5	Jan. 27	0.01
Gold Springs, Nev	Jan. 17	Feb. 3	0.04
Gould & Curry, Nev	Jan. 24	Feb. 13	0.05
Hancock Con., Mich	Jan. 10		1.00
Hancock, Mich	Mar. 28		1.00
King David, Utah	Feb. 13	Mar. 6	0.005
Ojibway, Mich	Jan. 10		1.00
Raven, Mont	Feb. 1		0.10
Savage, Nev	Feb. 14	Mar. 7	0.10
Seven Troughs Mon., Nev	Jan. 10	Jan. 31	0.002½
Sierra Nevada, Nev	Jan. 23	Feb. 13	0.10
Southwestern Miami, Ariz	Jan. 15		1.00
Spider, Utah	Jan. 15	Feb. 15	0.002½
Swansea Con., Utah	Jan. 17	Feb. 8	0.015
Tintic Standard, Utah	Jan. 8	Feb. 5	0.00
Utah, Nev	Jan. 19	Feb. 9	0.05
Yellow Jacket, Nev	Jan. 31	Mar. 6	0.10

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	.....	23.794	24.081	.....
March	51.454	52.745	.....	23.690	24.324	.....
April	53.221	53.325	.....	24.483	24.595	.....
May	53.870	53.308	.....	24.797	24.583	.....
June	53.462	53.043	.....	24.651	24.486	.....
July	54.150	52.630	.....	25.034	24.286	.....
August	52.912	52.171	.....	24.428	24.082	.....
September	53.295	52.440	.....	24.567	24.209	.....
October	55.490	53.340	.....	25.596	24.594	.....
November	55.635	55.719	.....	25.680	25.649	.....
December	54.428	54.905	.....	25.160	25.349	.....
Year	53.486	53.304	.....	24.670	24.592	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12.295	14.094	12.680	14.337	55.600	62.760
February	12.256	.....	12.611	.....	54.974	.....
March	12.139	.....	12.447	.....	54.704	.....
April	12.019	.....	12.275	.....	54.034	.....
May	11.989	.....	12.214	.....	54.313	.....
June	12.385	.....	12.611	.....	56.365	.....
July	12.463	.....	12.720	.....	56.673	.....
August	12.405	.....	12.634	.....	56.266	.....
September	12.201	.....	12.508	.....	55.253	.....
October	12.189	.....	12.370	.....	55.170	.....
November	12.616	.....	12.769	.....	57.253	.....
December	13.552	.....	13.768	.....	62.068	.....
Year	12.376	.....	12.634	.....	55.973	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41.255	42.529	July	42.400	.....
February	41.614	.....	August	43.319	.....
March	40.157	.....	September	39.755	.....
April	42.185	.....	October	41.185	.....
May	43.115	.....	November	43.125	.....
June	44.606	.....	December	44.655	.....
			Av. Year	42.281	.....

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4.483	4.435	4.334	4.327	13.009	15.619
February	4.440	.....	4.266	.....	13.043	.....
March	4.394	.....	4.238	.....	13.122	.....
April	4.412	.....	4.262	.....	12.889	.....
May	4.373	.....	4.223	.....	12.984	.....
June	4.435	.....	4.292	.....	13.260	.....
July	4.499	.....	4.397	.....	13.530	.....
August	4.500	.....	4.406	.....	14.260	.....
September	4.485	.....	4.356	.....	14.744	.....
October	4.265	.....	4.139	.....	15.332	.....
November	4.298	.....	4.181	.....	15.821	.....
December	4.450	.....	4.332	.....	15.648	.....
Year	4.420	.....	4.286	.....	13.970	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5.452	6.442	5.302	6.292	23.887	26.642
February	5.518	.....	5.368	.....	23.276	.....
March	5.563	.....	5.413	.....	23.016	.....
April	5.399	.....	5.249	.....	23.743	.....
May	5.348	.....	5.198	.....	24.375	.....
June	5.520	.....	5.370	.....	24.612	.....
July	5.695	.....	5.545	.....	25.006	.....
August	5.953	.....	5.803	.....	26.801	.....
September	5.869	.....	5.719	.....	27.750	.....
October	6.102	.....	5.951	.....	27.256	.....
November	6.380	.....	6.223	.....	26.795	.....
December	6.301	.....	6.151	.....	26.849	.....
Year	5.758	.....	5.608	.....	25.281	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer.		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15.90	$15.12	$14.40	$13.32	$14.75	$14.00
February	15.90	.....	14.50	.....	14.81	.....
March	15.90	.....	14.65	.....	14.96	.....
April	15.90	.....	14.65	.....	15.00	.....
May	15.90	.....	14.30	.....	14.72	.....
June	15.90	.....	14.06	.....	14.56	.....
July	15.90	.....	14.03	.....	14.53	.....
August	15.90	.....	14.00	.....	14.47	.....
September	15.90	.....	13.57	.....	14.40	.....
October	15.43	.....	13.44	.....	14.34	.....
November	14.92	.....	13.30	.....	14.25	.....
December	15.15	.....	13.10	.....	13.90	.....
Year	$15.72	.....	$13.94	.....	$14.49	.....

STOCK QUOTATIONS

COLO SPRINGS Jan. 30

Name of Comp.	Bid.
Acacia	.04⅜
Cripple Cr'k Con	.02⅛
C. K. & N	‡ 14
Doctor Jack Pot	.05⅝
Elkton Con	.62½
El Paso	.70½
Findlay	.05
Gold Dollar	.17
Gold Sovereign	.02½
Isabella	.14½
Jack Pot	.05⅝
Jennie Sample	.06½
Lexington	.01
Moon Anchor	.01½
Old Gold	.03
Mary McKinney	.50½
Pharmacist	.02½
Portland	.93
Vindicator	.63
Work	.02½

SALT LAKE Jan. 30

Name of Comp.	Bid.
Beck Tunnel	.13
Black Jack	.10½
Carisa	‡.17
Cedar Talisman	.02½
Colorado Mining	.32
Columbus Con	.22
Daly-Judge	‡5.20
Grand Central	.73
Iron Blossom	1.05
Little Bell	.40
Lower Mammoth	.02¾
Mason Valley	11.00
May Day	.15
Nevada Hills	2.25
New York	‡.07
Prince Con	.81
Silver King Coal'n	1.40
Sioux Con	.11
Uncle Sam	.33
Yankee	‡.24

TORONTO Jan. 30

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	7.00	Pearl Lake	.10
Hudson Bay	70.00	Porcu. Gold	.34
Temiskaming	.30	Porcu. Tisdale	.08
Wettlaufer-Lor	.80	Preston E. D	.05
Apex	.08	West Dome	.25
Central	‡3 62½	Standard	.15
Dobie	.50	Foley O'Brien	.25
Dome Exten	.28	Rea	1.18
Hollinger	12.00	Crown Chartered	.07
Imperial	.05	Swastika	.20

SAN FRANCISCO Jan. 30

Name of Comp.	Clg.
COMSTOCK STOCKS	
Alta	.01
Belcher	.48
Best & Belcher	.13
Caledonia	1.35
Challenge Con	.14
Chollar	.16
Confidence	.70
Con. Virginia	.76
Crown Point	.48
Gould & Curry	.08
Hale & Norcross	.17
Mexican	4.00
Occidental	.50
Ophir	1.45
Overman	1.05
Potosi	.07
Savage	.14
Sierra Nevada	.40
Union Con	1.20
Yellow Jacket	.41

Name of Comp.	Bid
MISC. NEV. & CAL.	
Belmont	8.72
Jim Butler	.32
MacNamara	.26
Midway	.28
Mont.-Tonopah	1.02½
North Star	.31
West End Con	.76
Atlanta	.18
Booth	.05
C.O.D. Con	.13
Comb. Frac	.13
Jumbo Extension	.20
Pitts.-Silver Peak	1.25
Silver Pick	.06
St. Ives	.30
Tramps Con	.01
Argonaut	2.50
Bunker Hill	‡3.00
Cent. Eureka	‡.36
So. Eureka	‡6.00

N. Y. EXCH. Jan. 30

Name of Comp.	Clg.
Amalgamated	62⅛
Am. Agri. Chem	61⅜
Am.Sm.&Ref.,com	70¼
Am. Sm.& Ref., pf.	103¼
Am. Sm. Sec., pf. B	86½
Anaconda	34⅝
Batopilas Min	1⅜
BethlehemSteelpf	60⅜
Chino	26
Federal M.& S., pf.	38
Goldfield Con	4⅛
Great Nor., ore ctf.	38¼
Homestake	90
Miami Copper	23⅞
Nat'nalLead,com.	54
National Lead, pf.	105
Nev. Consol	18⅛
Pittsburg Coal, pf.	85
Ray Con	16¾
RepublicI&S,com	23⅜
Republic I & S, pf.	81
SlossSheffi'd,com.	39½
Sloss Sheffield, pf.	108¼
Tennessee Copper	36¼
Utah Copper	54⅛
U. S. Steel, com	64
U. S. Steel, pf	110½
Va. Car. Chem	55½

N. Y. CURB Jan. 30

Name of Comp.	Clg.
Barnes King	‡.35
Beaver Con	.44
Braden Copper	5⅛
B. C. Copper	4⅛
Buffalo Mines	1.20
Butte & Vipond	.53
Butte Coalition	22⅛
Cobalt Central	‡.01
Con. Ariz Sm	1/16
Davis-Daly	1/16
Diam'field-Daisy	12
Ely Con	⅛
Florence	.55
Giroux	4⅞
Gold Hill Con	‡1/16
Greene Cananea	8
Greenwater	.07
Guggen. Exp	180
Inspiration	10
Internat. S. & R	‡12¼
Kerr Lake	2⅞
La Rose	3⅞
McKinley-Dar-Sa	1⅝
Min. Co. of A. new	4
Nev. Utah M. & S	⅛
Nipissing Mines	7⅝
Ohio Copper	1½
Pacific Sm. & M	1/16
Porcupine T'nsite	‡.03½
Precious Metals	‡1⅜
Ray Central	1⅛
Red Warrior	‡1⅜
South Utah M.& S.	1/16
Standard Oil (Old)	625
Stand'd Oil of N.J.	362
Stand'd Oil Subs.	330
Stewart	1¼
Tonopah	7⅜
Tonopah Ex	1⅛
Tri-Bullion	⅛
Tularosa	3⅛
Yukon Gold	3⅜

LONDON Jan. 31

Name of Com.	Clg.
Camp Bird	£1 12s 9d
Dolores	1 10 0
El Oro	0 19 0
Esperanza	2 10 0
Mexico Mines	7 7 6
Oroville	0 6 3
Stratton'sInd.	0 3 1½
Tomboy	1 2 6

BOSTON EXCH. Jan. 30

Name of Comp.	Clg.
Adventure	5
Algomah	6½
Allouez	39
Am. Zinc	25
Ariz. Com., ctfs.	3
Bonanza	.46
Boston & Corbin	7¾
Butte & Balak	3⅞
Calumet & Ariz	58¾
Calumet & Hecla	420
Centennial	17⅞
Con. Mercur	.06
Copper Range	50
Daly West	5
East Butte	12½
Franklin	12¾
Granby	34
Hancock	33¾
Hedley Gold	15¼
Helvetia	1
Indiana	13¼
Island Cr'k, com.	86⅛
Isle Royale	21⅛
Keweenaw	1¼
Lake	33½
La Salle	4¾
Live Oak	40½
Mass	7¾
Michigan	3¼
Mohawk	52½
New Arcadian	3½
New Idria Quick	7⅛
North Butte	24
North Lake	5¼
Ojibway	5½
Old Dominion	45
Osceola	107
Quincy	75
Shannon	9 7/16
Shattuck-Ariz	17
Superior	25½
Superior & Bost	4 9/16
Tamarack	26
Trinity	5⅝
Tuolumne	3 1/16
U. S. Smelting	35
U. S. Smelt'g, pf.	48
Utah Apex	3
Utah Con	15¼
Victoria	4⅜
Winona	5⅜
Wolverine	197½
Wyandot	2

BOSTON CURB Jan. 30

Name of Comp.	Last
Ahmeek	245
Bingham Mines	2⅞
Boston Ely	1½
Boswyocolo	.09
Cactus	.15
Calaveras	2
Chief Cons	.83
Corbin	3
Cortez	1½
Crown Reserve	3
First Nat. Cop	2⅜
Majestic	.41
Mazatan	1
Moneta Porc	.14
Nevada-Douglas	2 1/16
New Baltic	4½
Oneco	2½
Raven Copper	.23
Rhode Island Coal	.29
San Antonio	‡3½
South Lake	5⅞
Trethewey	.50
Union Mines	‡1½
United Verde Ext.	.53
Vulture	‡5⅞

‡Last quotation.